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RMRS Rocky Mountain
Remediation Services, L.L.C.
...protecting the environment

Management Plan for the Interceptor Trench System Water

Environmental Restoration
Rocky Flats Environmental Technology Site

May 1996

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Management Plan for the Interceptor Trench System Water

Rocky Mountain Remediation Services, L.L.C.

Environmental Restoration/
Waste Management Sitewide Actions

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ACRONYMS, ABBREVIATIONS, AND INITIALISMS

ASAP	Accelerated Site Action Project
BGCR	Background Geochemical Characterization Report
B374	Building 374
CWQCC	Colorado Water Quality Control Commission
DOE	Department of Energy
ITS	Interceptor Trench System
mgal	millions of gallons
mg/L	milligrams per liter
MST	Modular Storage Tank
NO_3 as N mg/L	nitrate as N concentration in milligrams per liter
OU	operable unit
pCi/L	picocuries per liter
RFCA	Rocky Flats Cleanup Agreement
RFEDS	Rocky Flats Environmental Database System
WWTP	Wastewater Treatment Plant

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EXECUTIVE SUMMARY

This management plan describes an alternative to the current practice of costly evaporation treatment of Interceptor Trench System (ITS) water in the Building 374 waste treatment facility at the Rocky Flats Environmental Technology Site (Site). The proposed management plan provides for the release of ITS water into the Site's storm-water system in such a manner as to protect water quality at all times. The Interceptor Trench System collects groundwater from below the site of the Solar Evaporation Ponds, previously used for waste disposal. Contamination from the ponds entered the groundwater and has been detected at the ITS Central Sump. The Department of Energy (DOE) agreed to treatment of the ITS waters as part of the interim measures for Operable Unit 4 (EG&G 1992). Since 1993, groundwater that is collected in the Interceptor Trench System is pumped to Building 374 for treatment in the evaporation units; this is a costly process that was previously dedicated to processing wastewater from production activities. To avoid unnecessary treatment costs without causing unacceptable risk to human health or the environment, alternatives for the disposal of ITS water are being sought. This management plan demonstrates compliance with the draft Rocky Flats Cleanup Agreement while reducing costs.

The proposed management plan encompasses three phases leading to the eventual closure of the Interceptor Trench System as part of the active remediation of the Site. During this period, active management of ITS water will assure that water-quality standards are met as required by the draft Rocky Flats Cleanup Agreement. The first phase requires compliance with the existing stream standard for nitrate, 10 miligrams per liter (mg/L). Data are presented showing that by actively managing the release of ITS water into the Site's storm-water retention pond system, adequate capacity exists to meet the existing standard. The second phase will be initiated when Option B projects are in place to completely isolate Site runoff from downstream water supplies, particularly Standley Lake and Great Western Reservoir. At this time, the nitrate stream standard is expected to change to 100 mg/L as outlined in the draft Rocky Flats Cleanup Agreement. The analysis provided in this plan demonstrates that passive management of ITS water during the second phase is feasible. The final phase would commence when a final disposition of the Interceptor Trench System is agreed upon by all stakeholders.

A detailed evaluation of Site hydrology, surface water flows and quality, and the impact of ITS water is provided in this plan. A computer model was developed to simulate water quality at points of compliance under the proposed phases of ITS management. Details of the calculations used in the analyses are provided, along with the complete set of water-flow information and water-quality data. For the first phase, two tasks were developed to test the feasibility of the proposed management plan. Annual average flows and water-quality data from the Interceptor Trench System and the Site were used to screen the proposal. Task 1 demonstrates that with an average water year, the combination of ITS water and Site runoff would not exceed the current stream standard for nitrate. Task 2 evaluates seasonal flows to ensure that even during periods of high runoff, the stream standard can be maintained. The second phase was evaluated in a single task, wherein the direct impact of ITS water on surface-water quality immediately below the ITS Central Sump was evaluated against the prospective stream standard of 100 mg/L. Again, the evaluation demonstrates the feasibility of the proposed management alternative.

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1.0 INTRODUCTION

The Interceptor Trench System (ITS) collects groundwater from below the site of the Solar Evaporation Ponds, previously used for waste disposal. Contamination from the ponds entered the groundwater and has been detected at the ITS pump station. The Department of Energy (DOE) agreed to the treatment of the ITS produced waters as part of the interim measures for Operable Unit 4 (OU 4) (EG&G 1992). Since 1993, groundwater collected in the ITS has been pumped to Building 374 (B374) for treatment in the evaporation units, a costly process previously dedicated to process wastewater from production activities. To avoid unnecessary treatment costs without causing unacceptable risk to human health or the environment, alternatives for the disposal of ITS water are being sought. The proposed management plan demonstrates compliance with the draft Rocky Flats Cleanup Agreement (RFCA), as well as reduces costs.

The draft RFCA contains a proposed Action Levels and Standards Framework for Surface Water, Groundwater and Soils. Under the Standards Framework, action levels are defined as numeric levels that, when exceeded, trigger an evaluation, remedial action, and/or management action. A standard is an enforceable narrative and/or numeric restriction established by regulation and applied to points of compliance.

The DOE believes that the primary constituent of concern in the ITS water is nitrate. If the collection and treatment of the water entering the ITS were to be discontinued, then it is anticipated that levels of nitrates in the groundwater and surface water would exceed the current proposed action levels in North Walnut Creek. However, nitrate and other parameters that have been observed above actions levels, specifically uranium and tritium, would meet the standard at the point of compliance. Plutonium and americium have not been detected in ITS water above the action levels since OU 4 was established.

The current action level and standard for nitrate is 10 milligrams per liter (mg/L). During the development of the Standards Framework, the parties discussed whether this was an appropriate standard for nitrates in consideration of current and anticipated downstream water and land uses. At that time, the agencies agreed that the agricultural use value for nitrates of 100 mg/L may be protective of human health and the environment, and the Colorado Water Quality Control Commission (CWQCC) could be petitioned in the future to propose a change in the nitrate standard if the DOE can provide sufficient rationale and justification to support the proposed change. The DOE anticipates petitioning the CWQCC during 1996. Until the CWQCC takes final action, the existing standard of 10 mg/L remains an action level and standard.

1.1 PURPOSE

The DOE proposes to discontinue treatment of the ITS water in B374. Alternative management actions have been evaluated that provide for compliance with the draft RFCA Action Levels and Standards Framework. The proposed actions use a phased approach in the management of ITS water. Phase I includes the cessation of treatment and the transport of ITS water directly to Pond A-4, the final point of discharge of surface water from the Site. Phase II includes the direct release of ITS water into the North Walnut Creek drainage, if the CWQCC approves the change in standards proposed in the draft RFCA. Phase III involves the complete decommissioning of the ITS, as scheduled in the overall plan for the Accelerated Site Action Project (ASAP).

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This change in operation for the management of ITS water would result in a number of significant improvements:

- Maintain compliance with the stream standard for nitrate in accordance with the draft RFCA
- Support the Site Vision and ASAP
- Provide a flexible management alternative which could include treatment, if needed
- Significantly reduce treatment costs

Several considerations were evaluated in developing an alternative for ITS water management. The corresponding flows and nitrate concentrations were evaluated to demonstrate the feasibility of directing ITS flow directly to Pond A-4. This plan provides an analysis of the impacts of ITS water on nitrate levels in Ponds A-3 and A-4. This work suggests that it is possible to accumulate ITS water in the Modular Storage Tanks (MSTs) and release it into either Pond A-3 or A-4, thereby consistently meeting the 10 mg/L nitrate stream standard. By releasing ITS water into Pond A-4 to meet the nitrate standard, other constituents are also expected to meet applicable stream standards.

The three phases that form the proposed management plan are as follows:

1. **Phase I – Immediate Release to Pond A-4 to meet 10 mg/L**

   Phase I would commence immediately upon final approval of the RFCA document and this proposed management plan. ITS water transport to, and treatment in B374 would stop, and the water would accumulate in the MSTs until transfer lines, monitoring equipment and instrumentation were in place. The ITS water would be discharged into Pond A-4. In accordance with the Pond Operations Plan (DOE 1995), Pond A-4 water quality will meet applicable standards at the point of compliance. Current operations include the pumping of water from Pond B-5 and batch releasing Pond A-3 into Pond A-4, where the water is held until analytical results show compliance with all stream standards. This proposed system includes sufficient instrumentation and control valving to control the flow from the MSTs into Pond A-4 and maintain 10 mg/L or less nitrate concentration in Pond A-4, which is the point of compliance.

   Sensors and instrumentation are currently available which can provide real-time monitoring of nitrate levels that would allow for continuous monitoring of the ITS water. With a nitrate probe and a control valve, the MSTs can be controlled to release only the amount of water into Pond A-4 that would not adversely impact water quality, (i.e., not exceed the 1-day maximum). Based on operating experience, the volume of water in the pond and the flow from the two major sources, Ponds A-3 and B-5, can be measured sufficiently to predict the impacts of ITS water. The current practice of isolating and holding water in Pond A-4 until approval to release is received, further assures that the standard for nitrate would not be exceeded due to inflow of ITS water.

   During Phase I, back-up treatment will be in place as a contingency in the event it is necessary. B374, which currently provides treatment of ITS water, will maintain the capability of adding additional operating personnel on an extra shift, to resume treatment. Operations

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will continue at B374 through Phase I of this proposed management plan, and will be available to accept ITS water should the need arise.

2. **Phase II – Free Release of ITS Water into North Walnut Creek**

Based on current levels of nitrate in ITS water and in North Walnut Creek, direct release of ITS water is feasible only if the stream standard is modified, as set forth in the draft RFCA. The impact of ITS water with high nitrate concentration on storm water flows in North Walnut Creek was evaluated and it was determined that the combination of ITS and storm water would be expected to meet 100 mg/L at Pond A-4, even under the extreme hydrologic conditions experienced in 1995. For this phase, rather than routing ITS water to Pond A-4, pumping activities will cease and the ITS water will be allowed to overflow the central pump and drain into North Walnut Creek.

This phase would commence upon final approval of the modification to the stream standard. As of the February 1996 meeting of the CWQCC, a comprehensive hearing on Rocky Flats issues is scheduled for December 1996, at which time it is expected that the nitrate issue will be considered. If approved, the action (to increase the nitrate standard to 100 mg/L) of the CWQCC would become effective after about three months or approximately by March 1997. If all parties agree that this date is acceptable for implementing Phase II, ITS water would not have to be stored in the MSTs during the months of April and May, when precipitation and runoff are the highest. Use of the MSTs would be discontinued, and plans for their eventual removal would be prepared.

3. **Phase III – Closure of the Interceptor Trench System**

Eventually, the ITS may no longer be necessary as a result of the cleanup and closure of OU 4. The costs associated with operation and maintenance will no longer be justified. Closure of the french-drain system would be completed in this phase, including grouting existing drains and conveyances to minimize the collection of groundwater and allowing the natural seepage of groundwater in the North Walnut Creek area. In this phase, the MSTs would be removed in accordance with an approved plan.

A proposal has been made to directly discharge the ITS water to Pond A-4 via pipeline using a managed discharge approach such that the applicable stream standards would be met for all Site surface waters. This analysis evaluates the potential effects, in terms of nitrate, uranium, and tritium loading into Pond A-4, from a managed assimilation of the ITS water into this pond. This plan compiles and assesses water quality and discharge information to support administrative decisions regarding the future management of ITS waters.

As a justification of the proposal, an analysis of the Site hydrology was performed using historical data for ITS flows and contaminant concentrations. This analysis assesses water quality and discharge information to support Phases I and II of the proposed management plan. The analysis for Phase I was performed in two tasks:

- Task 1: Determine if the combined *average* annual discharge from the A-Series drainage, the B-Series drainage, and the Wastewater Treatment Plant (WWTP) would be capable of assimilating *average* annual ITS discharge volumes while maintaining a nitrate as N (nitrate-N) concentration at or below 10 mg/L. Similar determinations are made for other constituents

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found in the ITS water, specifically uranium and tritium, and the ability of the discharge to meet existing site-specific stream standards.

- Task 2: Determine if the proposed Phase I ITS discharge, during the calendar years 1994 and 1995, would have been operationally successful given the large volumes of water, available hydraulic system storage capacity, and detention pond discharge schedules.

Under the proposed ITS discharge, ITS water would be pumped via pipeline to Pond A-4. The volumes of ITS water to be pumped would be based on the concentration/activity and volume available in Pond A-4 such that exceeding the standards would be avoided. The analyses for both tasks evaluate water-quality impacts to Walnut Creek if the ITS continues to operate by managed pumping to Pond A-4 and, when necessary, Pond A-3. These analyses assume that future water quality (for Pond A-3, Pond B-5, and ITS water) is similar to that from 1992 to 1996 as shown in Table 1-1.

The Task 1 analysis assumes that the combined *average* annual discharge volumes from all sources for Walnut Creek would be available in Pond A-4 to assimilate ITS water. Note that this analysis assumes that future discharge volumes (influent surface water, WWTP effluent, and ITS water) are similar to those from October 1, 1992 to January 31, 1996. The predicted assimilative ITS discharge volume that is based on the annual *average* available surface water, while maintaining Pond A-4 concentrations and activities at or below the site-specific standards, is summarized in Table 1-2.

Table 1-1 Annual Average Constituent Concentrations in Source Waters

	Average Nitrate-N Concentration (mg/L)	Average Total Uranium Activity (pCi/L)	Average Tritium Activity (pCi/L)
ITS	294	78	1032
Pond A-3 / A-Series Influent	1.06	3.03	59
Pond B-5 / B-Series Influent	2.91	1.3	97

Note: Total Uranium is the sum of U-233,234 and U-238.

Table 1-2 Predicted Annual Assimilative ITS Discharge Volume

Predicted Assimilative ITS Volume in mgal	*Avg* Annual Surface Water Available for Assimilation in mgal		Predicted Total Uranium Activity [pCi/L]	Predicte d Tritium Activity [pCi/L]	Predicted Nitrate-N Concentration [mg/L NO_3 as N]
	A-Series Drainage	B-Series Drainage			
3.33	42.52	79.83	3.92	109	10.0

Table 1-2 indicates that during an *average* year, Pond A-4 would be able to assimilate approximately 3.33 million gallons (mgal). The ITS discharges an average of 3 mgal annually (DOE 1994).

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Therefore, on an *average* annual basis it may be feasible to release ITS water to the ponds in a managed mode without exceeding the applicable standards. Note that the above analysis assumes that the annual ITS discharge is determined solely by annually available surface water volumes.

The ITS Central Sump responds to precipitation events with only a short lag time. Figure 1-1 shows the daily discharge volumes for North Walnut Creek and the ITS Central Sump. The correlation between the two discharges implies that infiltration to the ITS is fairly rapid, and precipitation drives both systems. This indicates that during periods of high ITS discharges, high surface water volumes would also be available for assimilation.

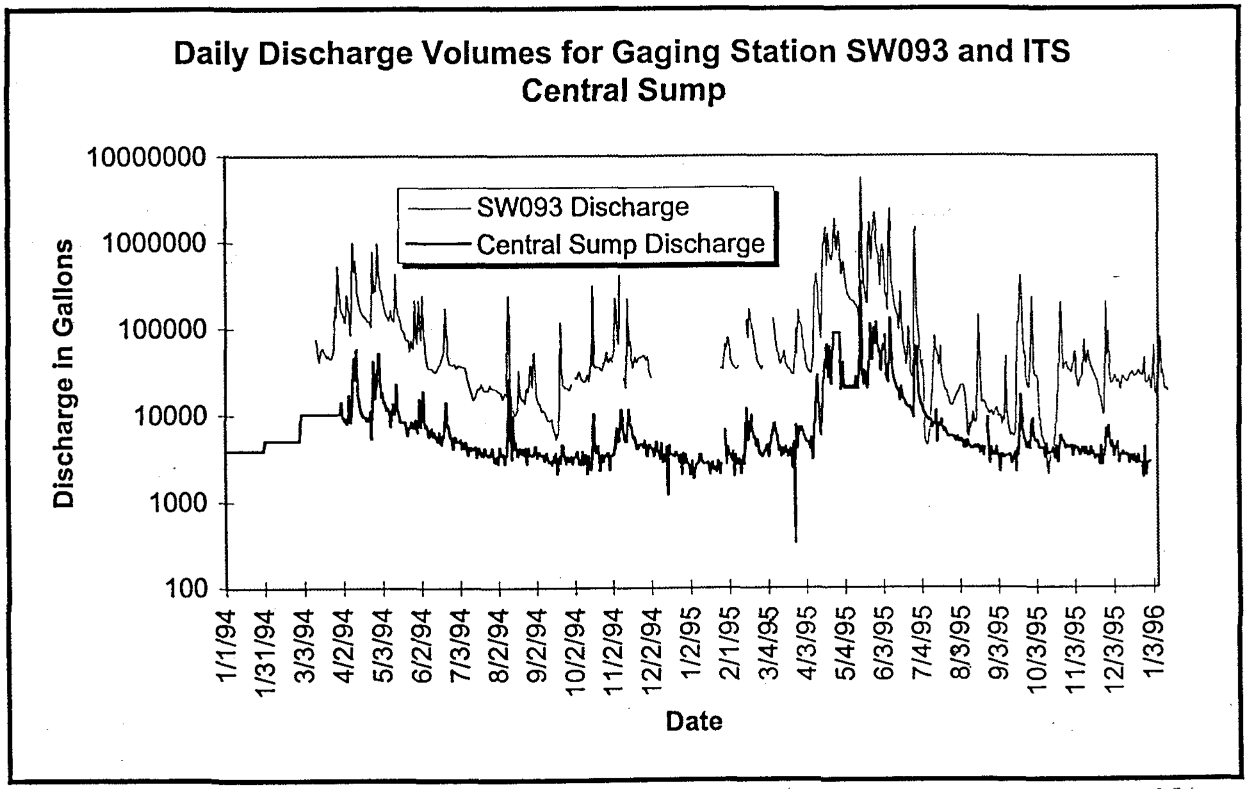

Figure 1-1 Daily Discharge Volumes for Gauging Station SW093 and the ITS Central Sump

During actual operation, however, discharge of the ITS would be constrained by surface water availability in Pond A-4 and detention pond management batch and release operations. Therefore, the ITS MSTs must have sufficient storage capacity to attenuate ITS inflows to allow for ITS discharges as surface water becomes available for assimilation. Task 2 addresses the dynamic response of the ITS under the proposed operating protocol using the actual hydrologic and pond management conditions which occurred during 1994 and 1995. Table 1-2 illustrates that nitrate is the limiting constituent of concern.

The Task 2 analysis incorporates the measured ITS discharges from calendar years 1994 and 1995 with the measured pond transfer volumes, and corresponding average nitrate - N concentrations. To give an understanding of the recurrence of the 1994-1995 precipitation totals, a brief analysis was performed. Using 105 years of historical precipitation data from Fort Collins, CO (Ft. Collins annual precipitation is considered representative of the Site because of the similar elevations, climate patterns, and annual means [Site: 14.37 in., 1988-1995; Ft. Collins: 14.92 in., 1889-1994]), biannual totals

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were calculated and a normal distribution was fit to the data as shown in Figure 1-2. Using the fit and the combined Site precipitation total of 33.15 in. from 1994-1995 (measured at the Site Met Tower), it can be seen that the probability of receiving similar precipitation volumes for any two adjacent years is (100%-73.5%) = 26.5%. This evaluation also indicates that the probability of receiving 33 in. of rain or less in any two consecutive years is more than 70%.

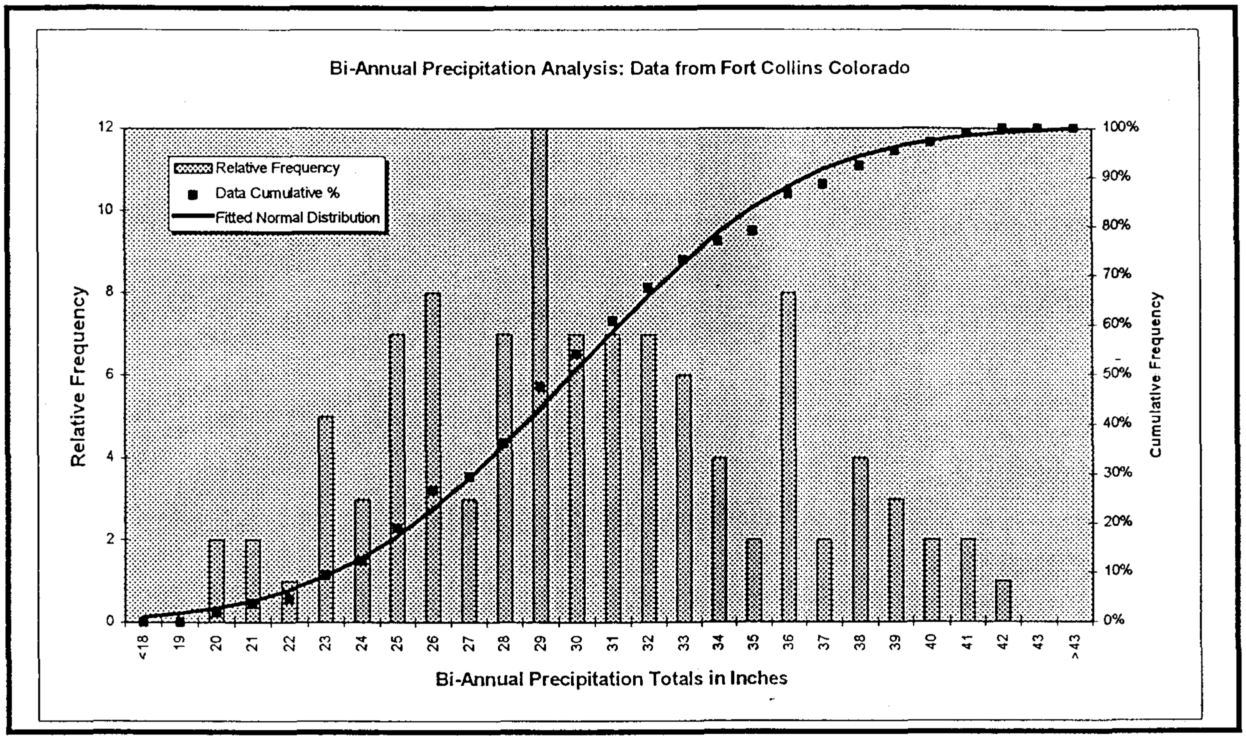

Figure 1-2 Biannual Precipitation Analysis: Data from Fort Collins, Colorado (1889-1994)

Using a daily time step, ITS waters were routed to Pond A-4 as water for assimilation became available, and dependent on the hydrologic conditions and pond management schedules. Specific operational nitrate - N concentrations in Pond A-4 were maintained at 8, 9, and 10 mg/L. Water volumes (gallons), nitrate - N loads (milligrams), and nitrate - N concentrations (mg/L) were tracked to predict time-variable ITS discharges and MST volumes, had the proposed ITS discharge protocol been in effect during 1994 and 1995.

Using an operational nitrate - N level of 9 mg/L in Pond A-4, the ITS/Pond A-4 system would have been able to assimilate ITS water effectively during 1994 and 1995. Figures 1-3 and 1-4 show the results of the analysis. A 9 mg/L was selected to provide an operational safety margin, while maintaining concentrations below the stream standard. The routing of ITS water began with the January 1, 1994 data point and it was observed that the system equilibrates during April 1994, as shown by the Pond A-4 concentration in Figure 1-3. The large spike in MST discharge to Pond A-4 represents the May 17, 1995 storm during which large volumes of ITS and surface water were available. Figure 1-4 shows that during the wet year of 1995, the total capacity of the MSTs would not have been exceeded. However, the figure shows that during all of 1994 and 1995, the MSTs have a net accumulation of water, indicating that a management level of 9 mg/L would not be sustainable indefinitely.

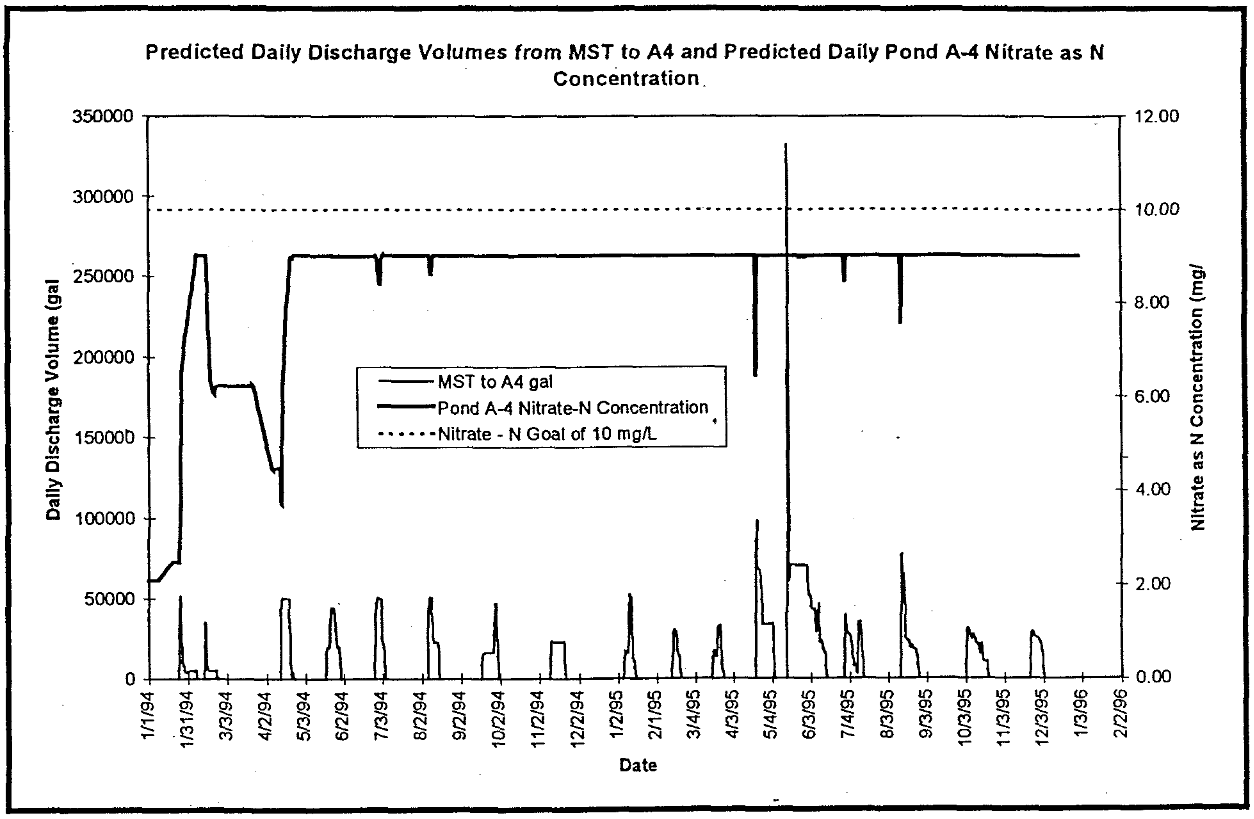

Figure 1-3 Predicted Daily Discharge Volumes from MSTs to A4 and Pond A-4 Nitrate as N Concentration

Using an operational concentration of 8 mg/L, ITS water would likely have accumulated in the MSTs to such an extent that an unacceptable overflow would have occurred. Using an operational concentration of 10 mg/L, ITS water would likely have not accumulated in the MSTs. This on operating, however, provides no safety margin for exceeding of the stream standard, and is likewise unacceptable.

Based on the detailed analyses in this plan, it can be seen that the ITS could be discharged to Pond A-4 while maintaining a nitrate-N concentration near 9 mg/L. Because of the carry-over of accumulated water from year to year, this mode of operation is sustainable for only 2-3 years before some other method would be necessary to remove the accumulated ITS water from the MSTs. The proposed discharge scenario is expected to occur for 1-1/2 years, and therefore, the potential constraint may not be limiting. Also, both analyses indicate a relatively small margin for error, emphasizing the need for accurate measurement of water quality and quantity to assure effective management of ITS waters and compliance with the stream standards.

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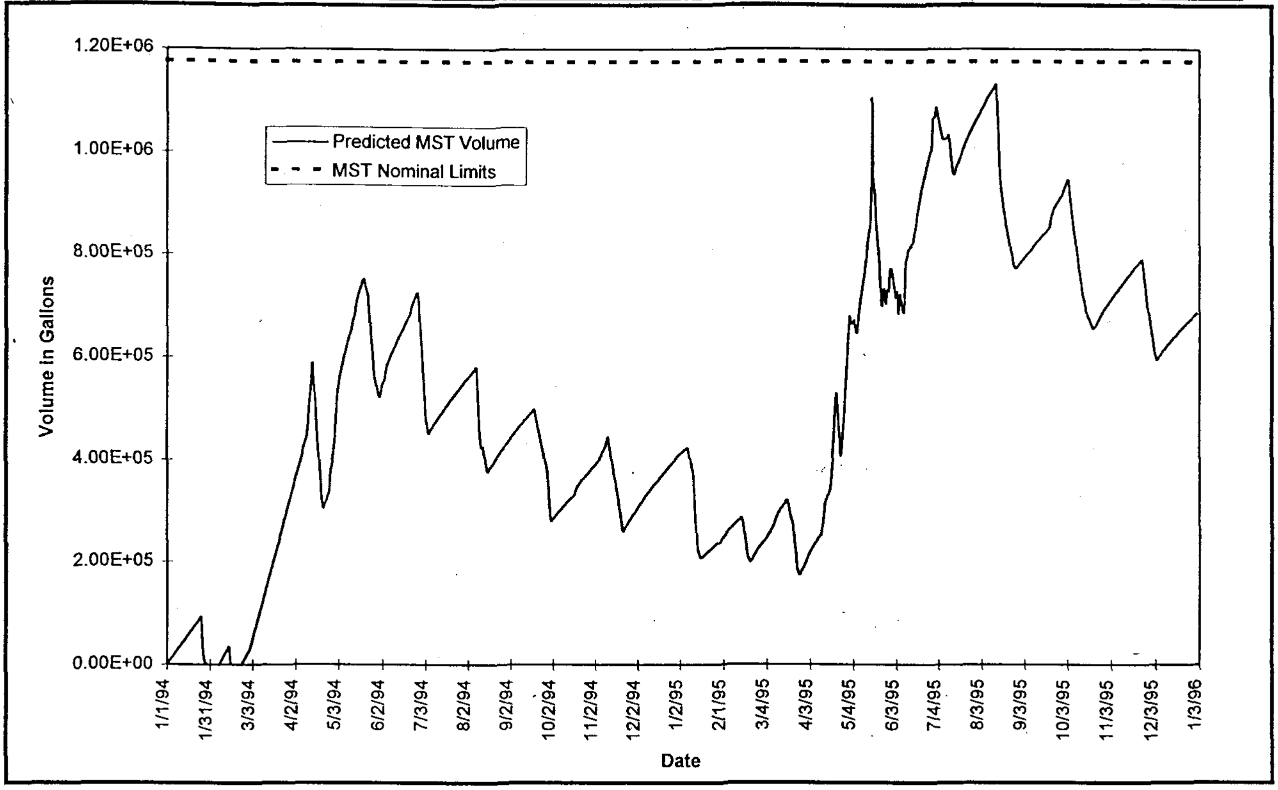

Figure 1-4 Predicted Cumulative MST Volumes Under 9 mg/L Management Protocol for Pond A-4

1.2 DATA ACQUISITION

1.2.1 Water Quality for Tasks 1 and 2

The average constituent concentrations calculated from available analytical data for the ITS, Pond A-3, and Pond B-5, waters are given in Table 1-3. The average nitrate concentration for the ITS was calculated from the most recent available 10 samples (11/8/93 to 9/29/95). Nine of the samples were taken at the surface water sampling location SW095 (ITS Central Sump); the remaining sample was taken at the ITS MSTs. The average total uranium activity for the ITS was calculated from all available samples (1/26/90 to 6/9/95). The average tritium activity for the ITS was calculated from the most recent 6 available samples (11/8/93 to 2/7/95). No tritium sample results were available for the period from 10/29/91 to 11/7/93.

Averages for Pond A-3 were used to represent water quality for A-Series inflows to Pond A-4. The average nitrate concentration for A-Series surface water was calculated from 87 samples taken at Pond A-3 from the period 2/14/94 to 1/5/96. The average total uranium activity for A-Series surface water was calculated from 18 samples taken at Pond A-3 from the period 4/6/93 to 5/27/95. The average tritium activity for A-Series surface water was calculated from 186 samples taken at Pond A-3 from the period 3/26/91 to 6/15/95.

Averages for Pond B-5 were used to represent water quality for B-Series inflows (transfers) to Pond A-4. The average nitrate concentration for Pond B-5 was calculated from 50 samples taken from the period 1/6/92 to 5/30/95. The average total uranium activity for Pond B-5 was calculated from 58 samples from the period 9/8/92 to 7/27/95. The average tritium activity for Pond B-5 was calculated from 171 samples from the period 1/14/91 to 6/11/95. These data are presented in Section 3.

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The analysis uses a spreadsheet solution to predict the time-variable response of various components of the system, had the proposed ITS managed discharge protocol been in place starting on January 1, 1994 and continuing through December 1995. The analysis incorporates the following assumptions.

- The ponds are completely mixed horizontally and vertically.

- Nitrate is a conservative constituent; no factor for biological uptake was used.

- Groundwater interactions and evaporation losses from Pond A-4 during times of ITS assimilation are negligible compared to the total surface water volumes.

To enhance the reliability of the completely mixed assumption, certain operational and physical items should be noted.

- All inputs to Pond A-4 (A-3, B-5, ITS) will occur at fairly high flow rates over short periods of time, resulting in mixing due to induced water currents. During a typical batch cycle, Pond A-4 volumes start at 10-20%, and increase to 50-60%. Typically, 12-15 mgal are moved to Pond A-4 over approximately 10 days.

- Transfers from A-3 and B-5 currently enter Pond A-4 in such a manner as to induce circular mixing.

- Once the transfers are complete, Pond A-4 is hydraulically isolated for 2-3 weeks pending analysis of a predischarge sample. During this time, diffusion and wind induced mixing are expected to occur.

- Engineering improvements, such as baffles or mechanical mixers, may be employed to facilitate complete mixing. Additionally, placement of the ITS transfer pipeline will enhance mixing.

All time-variable parameters for an ITS direct discharge to Pond A-4 (volume, load, and concentration) were made into discrete daily time steps. The calculations and variables are summarized in Tables 1-5 through 1-7.

to maximize the ITS discharge volume, while constraining the constituent activities to the applicable stream standards.

$$\frac{(\text{constituent load } [\text{pCi}])}{(\text{total discharge volume } [\text{L}])} = \text{resultant constituent activity } [\text{pCi/ L}] \qquad \text{Equation (1-2)}$$

where

$(\text{constituent load } [\text{pCi}]) =$ combined load from ITS, A-, and B-Series influent surface water

$(\text{total discharge volume } [\text{L}]) =$ combined discharge from ITS, A-, and B-Series influent surface water

The analysis showed that nitrate is the limiting constituent. Using the water quality values given in Table 1-3, and the maximum ITS discharge volume associated with the maximum nitrate concentration, the results in Table 1-4 were obtained. Table 1-4 indicates that during a year with *average* hydrologic and WWTP conditions, Pond A-4 would potentially be able to assimilate 3.33 mgal of ITS water.

It is assumed for this analysis that all Site surface water is routed through Pond A-4 per current pond operations protocol. Note that this analysis assumes that the average annual assimilative ITS discharge is determined solely by average annually available surface water volumes and their corresponding activities and concentrations. However, during the proposed ITS operation, discharge of the ITS would be constrained by the temporal availability of surface water in Pond A-4 and detention pond batch and release operations. Therefore, the MSTs must have sufficient storage capacity to attenuate ITS inflows, to allow for ITS discharges as surface water becomes available for assimilation. Task 1I addresses the dynamic response of the ITS by evaluating the applicability of the proposed operating protocol to the actual hydrologic and pond management conditions which occurred during 1994 and 1995.

Table 1-4 Predicted Annual Assimilative ITS Discharge Volume

Predicted Assimilative ITS Volume in Mgal	*Average* Annual Surface Water Available for Assimilation in Mgal		Predicted Total Uranium Activity [pCi/L]	Predicted Tritium Activity [pCi/L]	Predicted Nitrate-N Concentration [mg/L NO_3^- as N]
	A-Series Drainage	B-Series Drainage			
3.33	42.52	79.83	3.9	109	10.0

1.5 METHOD AND RESULTS FOR TASK 2

Figure 1-6 shows the elements of the ITS and Pond A-4 system used in Task 2 to route the ITS water through the system. The MST routing to Pond A-3 would only be used in conditions where the MSTs are in danger of overtopping. It should be noted that assimilating ITS water to Pond A-3 diminishes future assimilation capacity for Pond A-4, as all Pond A-3 water is routed through Pond A-4 per current pond operations protocol.

1.4 METHOD AND RESULTS FOR TASK 1

The key elements of the ITS and Pond A-4 system used in Phase I of this management plan are shown in Figure 1-5. This figure shows all sources of water used in Task 1 to evaluate the impact of ITS water on annual average discharge concentrations.

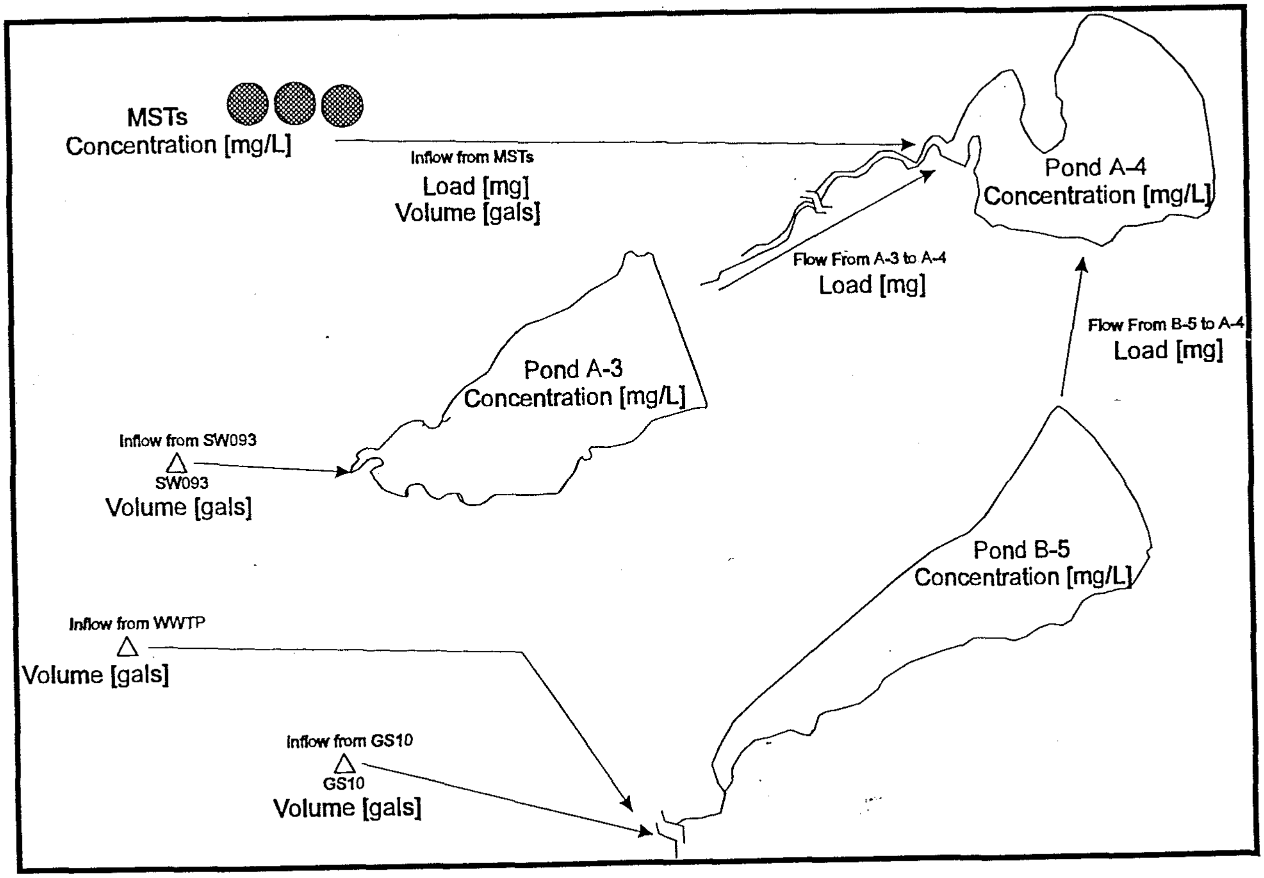

Figure 1-5 Conceptual Representation of Task 1 Analysis for Proposed ITS Managed Discharge Approach

The predicted annual assimilative ITS volume in Pond A-4 was calculated on a mass loading basis using surface water sources. The following equation was solved iteratively to maximize the ITS discharge volume, while constraining the Pond A-4 nitrate concentration to 10 mg/L.

$$\frac{(\text{total nitrate-N load [mg]})}{(\text{total discharge volume [L]})} = \text{resultant A-4 nitrate-N concentration [mg/L]} \qquad \text{Equation (1-1)}$$

where

$(\text{total nitrate-N load [mg]}) =$ combined load from ITS, A-, and B-Series influent surface water

$(\text{total discharge volume [L]}) =$ combined discharge from ITS, A-, and B-Series influent surface water

Similarly, for total uranium and tritium, the predicted annual activities in Pond A-4 were calculated on an activity loading basis using surface water sources. The following equation was solved iteratively

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Table 1-3 Annual Average Constituent Concentrations in Source Waters

	Average Nitrate - N Concentration [mg/L]	Average Total Uranium Activity [pCi/L]	Average Tritium Activity [pCi/L]
ITS	294 No. of Samples: 10 Dates: 11/8/93 to 9/29/95	78 No. of Samples: 5 Dates: 1/26/90 to 6/9/95	1032 No. of Samples: 6 Dates: 11/8/93 to 2/7/95
Pond A-3 / A-Series Influent	1.06 No. of Samples: 87 Dates: 2/14/94 to 1/5/96	3.03 No. of Samples: 18 Dates: 4/6/93 to 5/27/95	59 No. of Samples: 186 Dates: 3/26/91 to 6/15/95
Pond B-5 / B-Series Influent	2.91 No. of Samples: 50 Dates: 1/6/92 to 5/30/95	1.3 No. of Samples: 58 Dates: 9/8/92 to 7/27/95	97 No. of Samples: 171 Dates: 1/14/91 to 6/11/95

Note: Total Uranium is the sum of U-233,234 and U-238.

1.3 WATER DISCHARGE VOLUMES

1.3.1 Task 1

Average monthly discharge volumes for influent surface water for North Walnut Creek (A-Series) were calculated using actual discharge data measured at gaging stations GS13 and SW093 from the period 10/1/92 to 2/29/96. Discharge volumes for South Walnut Creek (B-Series) are the sum of influent surface water and WWTP effluent volumes. Average monthly discharge volumes for B-Series influent water were calculated using actual discharge data measured at gaging station GS10 from the period 10/1/92 to 1/31/96. Average monthly discharge volumes for the WWTP were calculated using data recorded at the WWTP from the period 10/1/92 to 1/31/96.

1.3.2 Task 2

Daily transfer volumes from Pond A-3 to Pond A-4 were calculated from flow measurements taken at gaging station GS12, located at the Pond A-3 outlet works. Daily transfer volumes from Pond B-5 to Pond A-4 were calculated from flow measurements taken in the B-5 to A-4 transfer pipe. Daily discharge volumes from Pond A-4 to Walnut Creek were calculated from flow measurements taken at gaging station GS11, located at the Pond A-4 outlet works. Where actual flow measurements were missing or determined to be incorrect, daily water volumes were calculated from measured pond volume changes recorded in support of pond water management activities.

Pond volumes for Ponds A-3, A-4, and B-5 were recorded in support of pond water management activities about 3 times a week. Pond volumes were estimated for days between actual pond volume field measurements.
Daily water inflow volumes to the MSTs were calculated from flow measurements taken from a flow meter at the ITS Central Sump (SW095). When actual flow measurements were missing, daily inflow volumes were calculated using MST volume changes.

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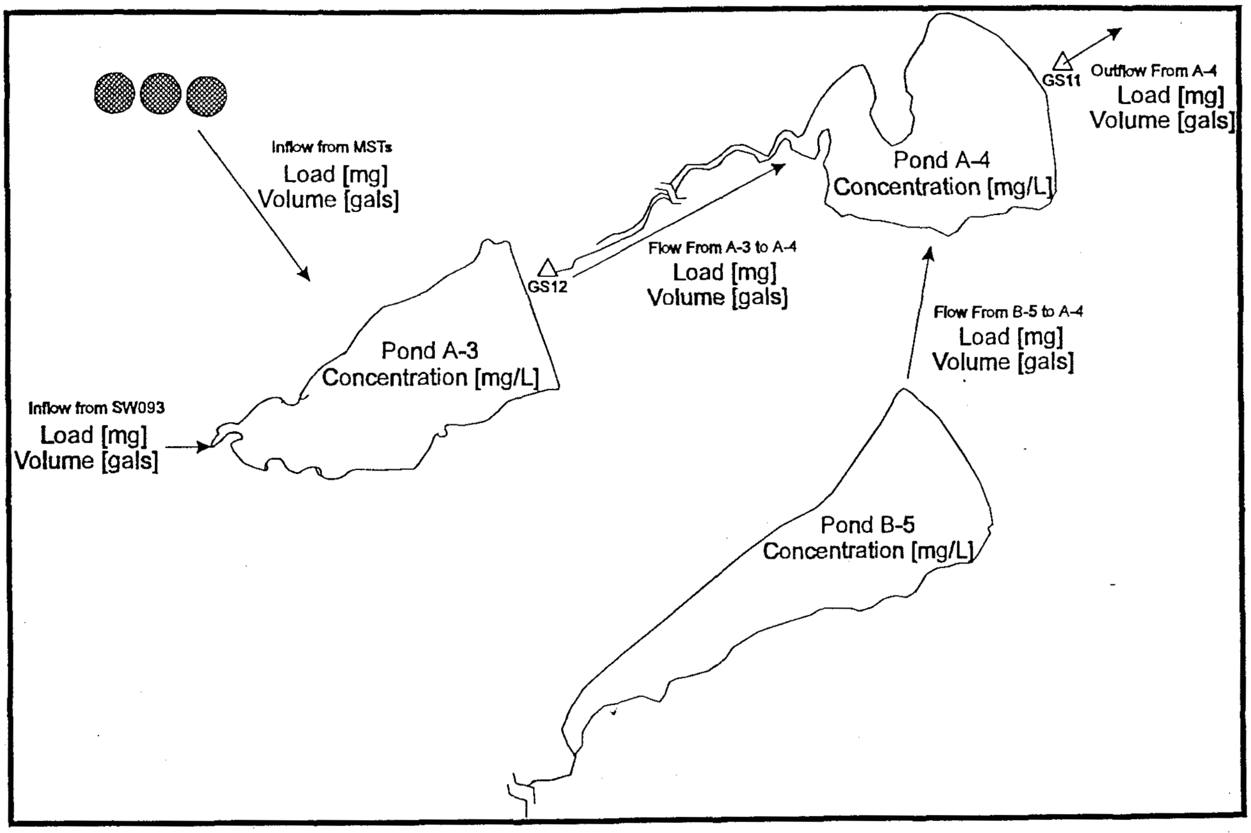

Figure 1-6 Conceptual Representation of Task 2 Analysis for Proposed ITS Managed Discharge Approach

Table 1-5 Time Variable Equations for Volumes

Volumes: Liters							
Time Step	MST Inflow $V_{ITS \to MST}$	MST Tanks V_{MST}	MSTs to A-4 $V_{MST \to A4}$	A-3 to A-4 $V_{A3 \to A4}$	B-5 to A-4 $V_{B5 \to A4}$	A-4 Outflow V_{A4out}	Pond A-4 V_{A4}
⋮ T^{i-1}	$V^{i-1}_{ITS \to MST}$	$V^{i-1}_{MST} = V^{i-2}_{MST} + V^{i-2}_{ITS \to MST} - V^{i-2}_{MST \to A4}$	$V^{i-1}_{MST \to A4}$	$V^{i-1}_{A3 \to A4}$	$V^{i-1}_{B5 \to A4}$	V^{i-1}_{A4out}	$V^{i-1}_{A4} = V^{i-2}_{A4} + V^{i-2}_{MST \to A4} + V^{i-2}_{A3 \to A4} + V^{i-2}_{B5 \to A4} - V^{i-2}_{A4out}$
T^{i}	$V^{i}_{ITS \to MST}$	$V^{i}_{MST} = V^{i-1}_{MST} + V^{i-1}_{ITS \to MST} - V^{i-1}_{MST \to A4}$	$V^{i}_{MST \to A4}$	$V^{i}_{A3 \to A4}$	$V^{i}_{B5 \to A4}$	V^{i}_{A4out}	$V^{i}_{A4} = V^{i-1}_{A4} + V^{i-1}_{MST \to A4} + V^{i-1}_{A3 \to A4} + V^{i-1}_{B5 \to A4} - V^{i-1}_{A4out}$
T^{i+1} ⋮	$V^{i+1}_{ITS \to MST}$	$V^{i+1}_{MST} = V^{i}_{MST} + V^{i}_{ITS \to MST} - V^{i}_{MST \to A4}$	$V^{i+1}_{MST \to A4}$	$V^{i+1}_{A3 \to A4}$	$V^{i+1}_{B5 \to A4}$	V^{i+1}_{A4out}	$V^{i+1}_{A4} = V^{i}_{A4} + V^{i}_{MST \to A4} + V^{i}_{A3 \to A4} + V^{i}_{B5 \to A4} - V^{i}_{A4out}$

Table1-6 Time Variable Equations for Concentrations

Concentrations: mg/L nitrate as N				
Time Step	MST s_{MST}	Pond A-3 s_{A3}	Pond B-5 s_{B5}	Pond A-4 s^{i}_{A4}
⋮ T^{i-1}	294	1.06	2.91	$s^{i-1}_{A4} = W^{i-1}_{A4} / V^{i-1}_{A4}$
T^{i}	294	1.06	2.91	$s^{i}_{A4} = W^{i}_{A4} / V^{i}_{A4}$
T^{i+1} ⋮	294	1.06	2.91	$s^{i+1}_{A4} = W^{i+1}_{A4} / V^{i+1}_{A4}$

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Table1-7 Time Variable Equations for Loads

	Loads: mg nitrate as N				
Time Step	MSTs to A-4 $W_{MST \to A4}$	A-3 to A-4 $W_{A3 \to A4}$	B-5 to A-4 $W_{B5 \to A4}$	A-4 Outflow $W_{A4\,out}$	Pond A-4 W_{A4}
⋮ T^{i-1}	$W^{i-1}_{MST \to A4} = \left(s^{i-1}_{MST}\right)\left(V^{i-1}_{MST \to A4}\right)$	$W^{i-1}_{A3 \to A4} = \left(s^{i-1}_{A3}\right)\left(V^{i-1}_{A3 \to A4}\right)$	$W^{i-1}_{B5 \to A4} = \left(s^{i-1}_{B5}\right)\left(V^{i-1}_{B5 \to A4}\right)$	$W^{i-1}_{A4out} = \left(s^{i-1}_{A4}\right)\left(V^{i-1}_{A4out}\right)$	$W^{i-1}_{A4} = W^{i-2}_{A4} + W^{i-2}_{MST} + W^{i-2}_{A3 \to A4} + W^{i-2}_{B5 \to A4} - W^{i-2}_{A4out}$
T^{i}	$W^{i}_{MST \to A4} = \left(s^{i}_{MST}\right)\left(V^{i}_{MST \to A4}\right)$	$W^{i}_{A3 \to A4} = \left(s^{i}_{A3}\right)\left(V^{i}_{A3 \to A4}\right)$	$W^{i}_{B5 \to A4} = \left(s^{i}_{B5}\right)\left(V^{i}_{B5 \to A4}\right)$	$W^{i}_{A4out} = \left(s^{i}_{A4}\right)\left(V^{i}_{A4out}\right)$	$W^{i}_{A4} = W^{i-1}_{A4} + W^{i-1}_{MST} + W^{i-1}_{A3 \to A4} + W^{i-1}_{B5 \to A4} - W^{i-1}_{A4out}$
T^{i+1} ⋮	$W^{i+1}_{MST \to A4} = \left(s^{i+1}_{MST}\right)\left(V^{i+1}_{MST \to A4}\right)$	$W^{i+1}_{A3 \to A4} = \left(s^{i+1}_{A3}\right)\left(V^{i+1}_{A3 \to A4}\right)$	$W^{i+1}_{B5 \to A4} = \left(s^{i+1}_{B5}\right)\left(V^{i+1}_{B5 \to A4}\right)$	$W^{i+1}_{A4out} = \left(s^{i+1}_{A4}\right)\left(V^{i+1}_{A4out}\right)$	$W^{i+1}_{A4} = W^{i}_{A4} + W^{i}_{MST} + W^{i}_{A3 \to A4} + W^{i}_{B5 \to A4} - W^{i}_{A4out}$

KEY:

V = water volume, in liters
s = concentration, in mg / L nitrate as N
W = load, in milligrams nitrate as N

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The spreadsheet solution was used to track each of the above values for each time step from the period of January 1, 1994 to December 31, 1995. First, the measured MST inflows, pond transfer volumes (A-3 to A-4, B-5 to A-4), and corresponding average nitrate - N concentrations were put into the spreadsheet for the corresponding time steps. The initial Pond A-4 nitrate load was determined from actual A-4 volume measurements and sample results from the first week of January 1994. The MST to Pond A-4 discharge volumes were then entered when Pond A-4 had assimilation capacity and was not hydrologically isolated pending the receipt of pond operations sample results. A specific operational nitrate - N concentration in Pond A-4 was maintained by controlling the MST discharge volumes.

1.5.1 Results of Run 1 Managed at 9 mg/L Nitrate as N in Pond A-4

Using an operational nitrate - N level of 9 mg/L in Pond A-4, the ITS/Pond A-4 system would have been able to assimilate ITS water effectively during 1994 and 1995. Figures 1-7 and 1-8 show the results of the analysis. The routing of ITS water began with the January 1, 1994 data point and it was observed that the system equilibrates during April 1994 as shown by the Pond A-4 concentration in Figure 1-7. The jagged nature of the MST discharges and volumes is due to the intermittent availability of surface water for assimilation from batch and release pond operations. The large spike in MST discharge to Pond A-4 represents the May 17, 1995 storm during which large volumes of ITS and surface water were available. During this period, the A-Series Ponds were in flow-through operation, and personnel would have been required at the MSTs to allow for continuous MST discharge to the available surface water. Figure 1-8 shows that during the wet year of 1995, the MSTs could have been discharged at a rate such that the nominal volume would not have been exceeded. However, during that period the MSTs ran a deficit, indicating that a management level of 9 mg/L would likely be unsustainable indefinitely, as some ITS water would be carried over into subsequent years.

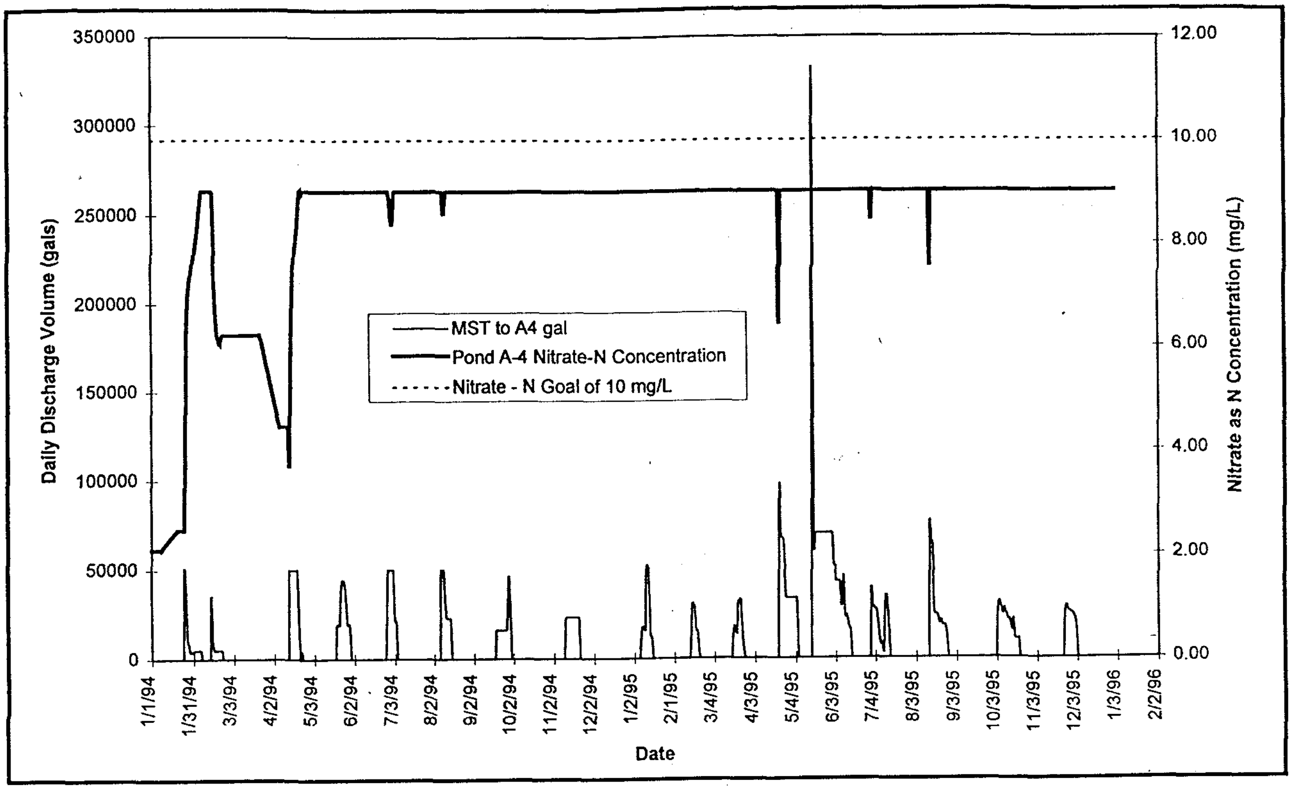

Figure 1-7 Predicted Daily Discharge Volumes from MSTs to A4 and Pond A-4 Nitrate as N Concentration Managed at 9 mg/L Nitrate as N

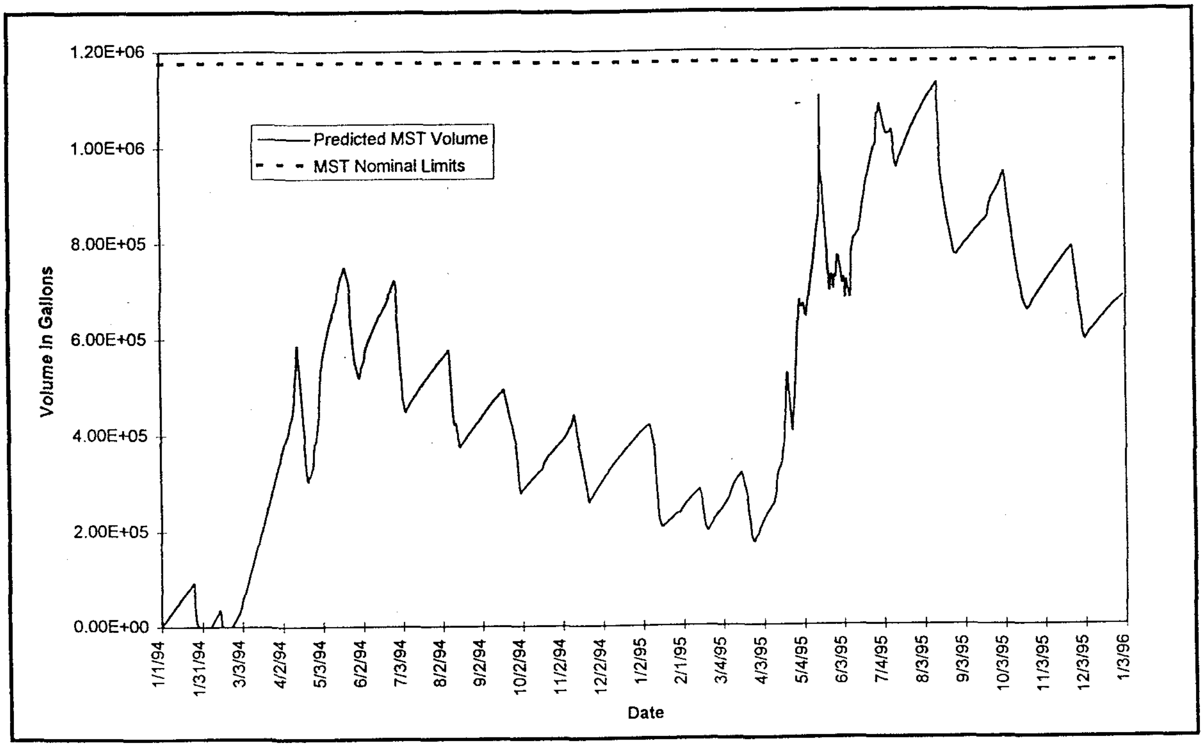

Figure 1-8 Predicted Cumulative MST Volumes Under 9 mg/L Management Protocol for Pond A-4

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1.5.2 Results of Run 2 Managed at 10 mg/L Nitrate as N in Pond A-4

Using an operational nitrate - N level of 10 mg/L in Pond A-4, the ITS/Pond A-4 system would have been able to assimilate ITS water effectively during 1994 and 1995. Figures 1-9 and 1-10 show the results of the analysis. The routing of ITS water began with the January 1, 1994 data point and it was observed that the system equilibrates during April 1994, as shown by the Pond A-4 concentration in Figure 1-9. Figure 1-10 shows that during the wet year of 1995, the MSTs could have been discharged at a rate such that the nominal volume would not have been exceeded. Also, during that period the MSTs were drained during the winter months, indicating that a management level of 10 mg/L would have possibly been sustainable indefinitely. However, managing the ITS discharges for 10 mg/L in Pond A-4 (the current standard) would not allow for any safety margin.

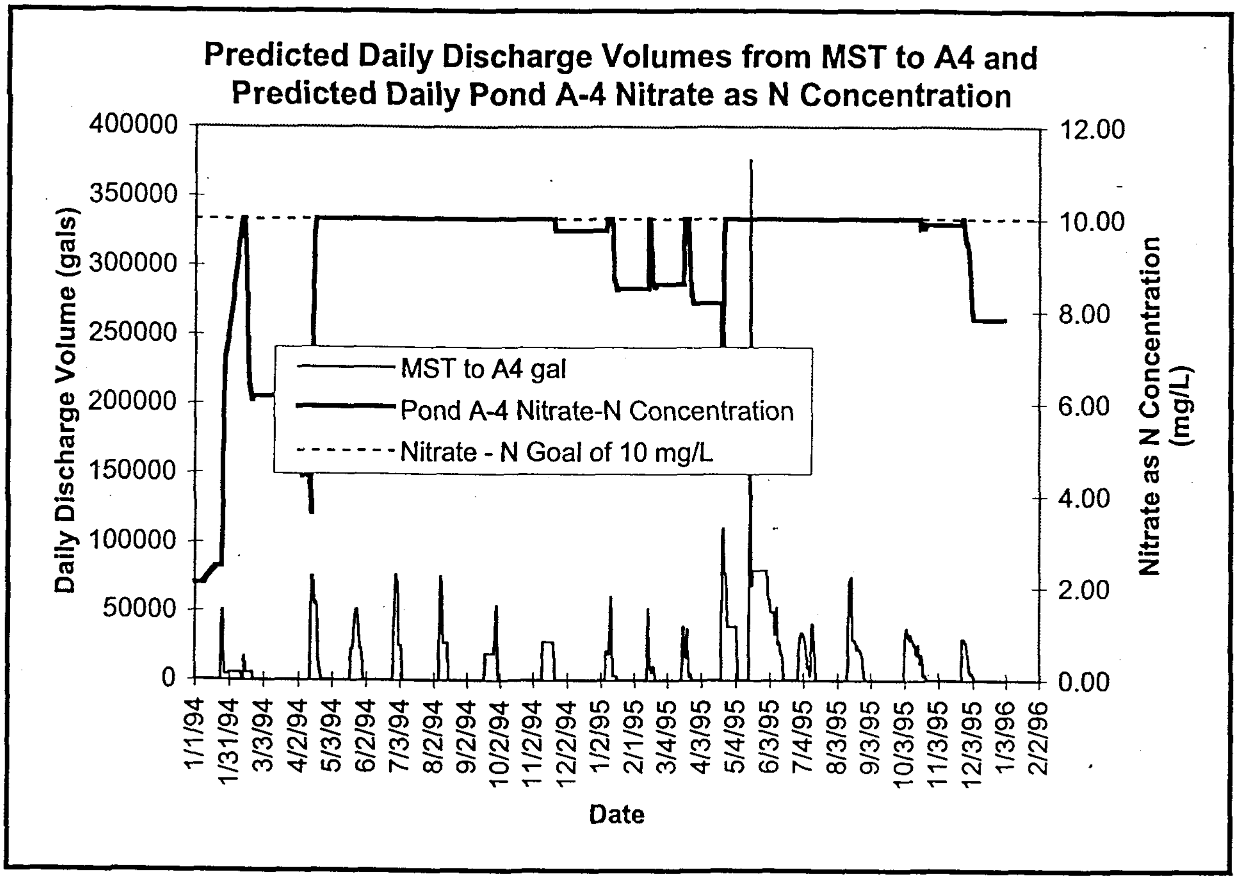

Figure 1-9 Predicted Daily Discharge Volumes from MSTs to A4 and Pond A-4 Nitrate as N Concentration Managed at 10 mg/L Nitrate as N

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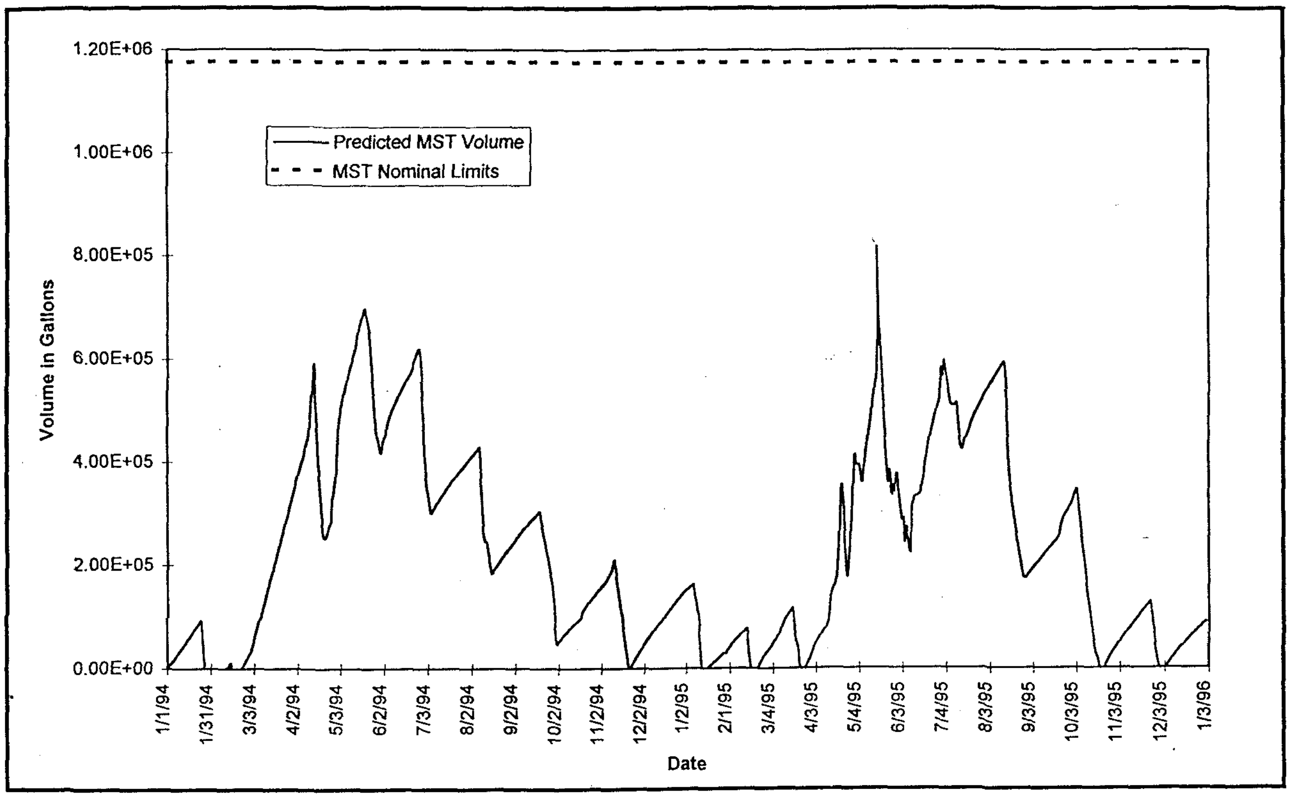

Figure 1-10 Predicted Cumulative MST Volumes Under 10 mg/L Management Protocol for Pond A-4

1.5.3 Results of Run 3 Managed at 8 mg/L Nitrate as N in Pond A-4

Using an operational nitrate - N level of 8 mg/L in Pond A-4, the ITS/Pond A-4 system would not have been able to assimilate ITS water effectively during 1994 and 1995. Figures 1-11 and 1-12 show the results of the analysis. The routing of ITS water began with the January 1, 1994 data point and it was observed that the system equilibrates during April 1994, as shown by the Pond A-4 concentration in Figure 1-11. Figure 1-12 shows that during the wet year of 1995, the MSTs could not have been discharged at a rate such that the nominal volume would not have been exceeded.

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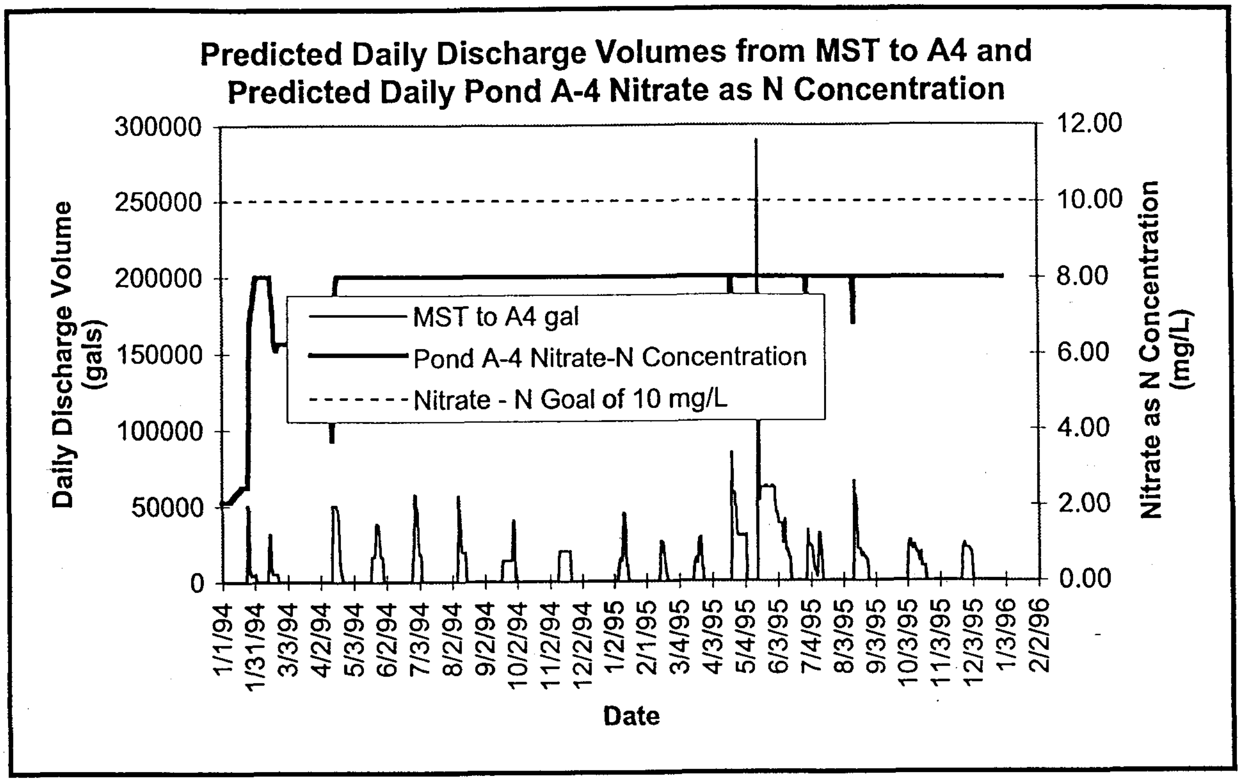

Figure 1-11 Predicted Daily Discharge Volumes from MSTs to A4 and Pond A-4 Nitrate as N Concentration Managed at 8 mg/L Nitrate as N

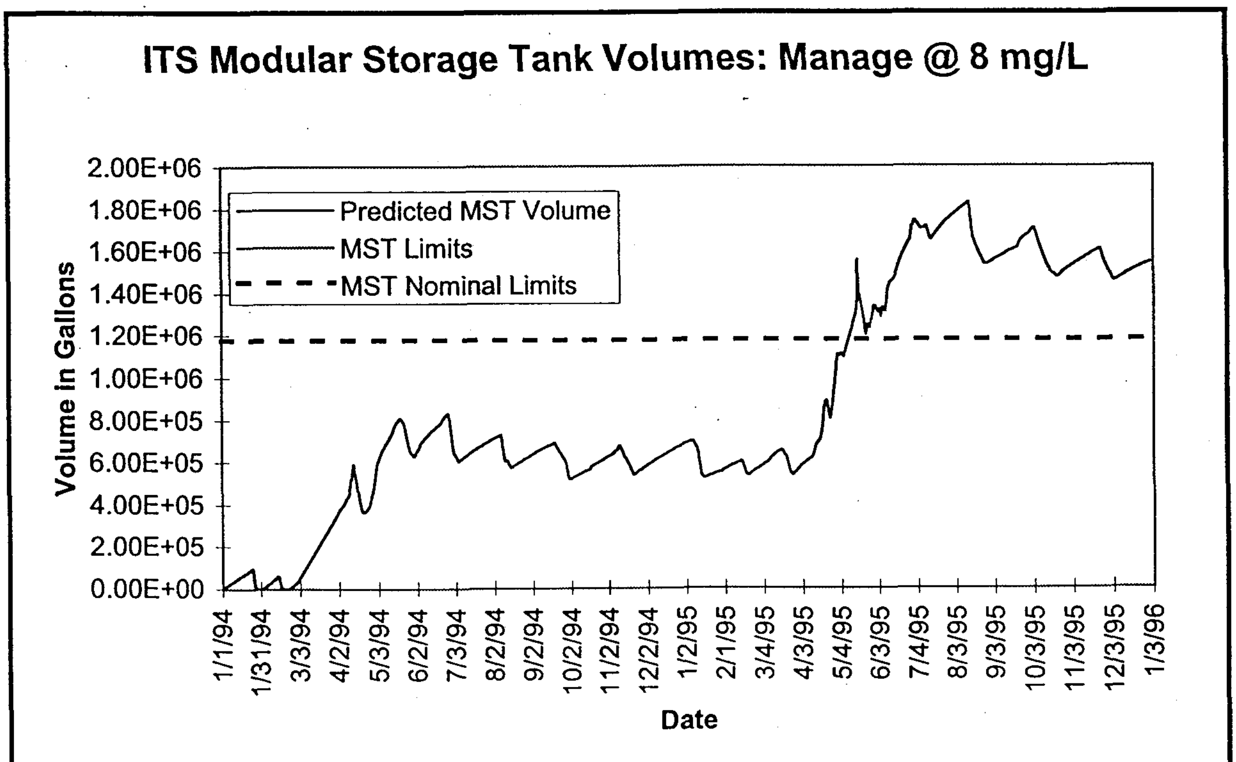

Figure 1-12 Predicted Cumulative MST Volumes Under 8 mg/L Management Protocol for Pond A-4

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2.0 LONG-TERM ALTERNATIVE

2.1 SUMMARY

This analysis evaluates the water-quality impacts to North Walnut Creek under Phase II, wherein ITS water discharges directly to the creek. Predicted seasonal *average* concentrations and activities for North Walnut Creek at the proposed ITS discharge point are summarized in Table 2-1. Note that this analysis assumes that future *average* discharge volumes (surface water and ITS water) are similar to those from October 1, 1992 to February 29, 1996. This analysis also assumes that future *average* water quality (for surface water and ITS water) is similar to that from 1990 to 1995.

Table 2-1 Average Predicted Seasonal Water-Quality Values in North Walnut Creek from Proposed ITS Discharge

Season	Average Predicted Nitrate Concentration [mg/L NO^-_3 - N]	Average Predicted Total Uranium Activity [pCi/L]
Dec, Jan, Feb	32	9.7
Mar, Apr, May	20	6.6
Jun, Jul, Aug	35	8.7
Sep, Oct, Nov	18	6.7

Note: Values above are for resultant North Walnut Creek surface water (combined influent surface water and ITS water) at proposed ITS discharge point in North Walnut Creek near the ITS Central Sump (sample location SW095).

Total Uranium is the sum of activities for U-233, 234 and U-238.

Note that the above predicted values are seasonal averages. Actual discrete water-quality measurements would vary in time. For example, during periods of low influent surface water flows (low receiving water baseflow in North Walnut Creek; may be zero during some times), resultant water quality in North Walnut Creek will approach that of the ITS discharge water. Therefore, actual maximum and minimum resultant North Walnut Creek water-quality values depend strongly on the future quantity and quality of both the ITS and the receiving North Walnut Creek waters.

However, actual sampled water quality will be dependent on the location and frequency of sampling operations. For instance, daily water quality fluctuations in North Walnut Creek will be attenuated by the standing water in Ponds A-3 and A-4 during batch operations. Once the Pond B-5 outlet works are upgraded, and B-5 is subsequently direct discharged, Pond A-4 will need to be discharged only 3–4 times annually. These 13–18 week cycles will effectively result in 90-125 day water-quality averages.

2.2 PHASE II ANALYSIS RESULTS

Seasonal average flow values were calculated for both the North Walnut Creek surface water and the ITS. These values were calculated based on flow information from the period of October 1, 1992 to February 29, 1996. Average water-quality values were calculated from selected Rocky Flats Environmental Database System (RFEDS) data collected during the period from 1990 to 1995. Table 2-2 and Figures 2-1 through 2-4 show the results of the seasonal loading and activity/concentration

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calculations, which describe average predicted seasonal water quality in North Walnut Creek resulting from potential ITS discharge to North Walnut Creek.

- Influent surface water is measured at SW093, just upstream from SW095.
- ITS water is measured in the ITS Central Sump (SW095).
- North Walnut Creek is surface water which would be measured downstream from SW095. This surface water would be the combination of influent surface water and the ITS discharge.

Table 2-2 Summary of Results for North Walnut Creek and ITS: Average Predicted Seasonal Loads, Activities, and Concentrations

	Average Total Nitrate Load in Grams			Average Nitrate-N Concentration in mg/L		
	Influent Surface Water	*ITS*	*ITS % Contribution*	*Influent Surface Water*	*ITS*	*N. Walnut Cr.*
Dec, Jan, Feb	103116	1637466	94%	1.81	294	32
Mar, Apr, May	702749	7876847	92%	1.77	294	20
Jun, Jul, Aug	91722	3517626	97%	0.45	294	35
Sep, Oct, Nov	79894	1752271	96%	0.71	294	18

	Average Total Uranium Load in Grams			Average Total Uranium Activity in pCi/L		
	Influent Surface Water	*ITS*	*ITS % Contribution*	*Influent Surface Water*	*ITS*	*N. Walnut Cr.*
Dec, Jan, Feb	947	2104	69%	2.42	78.00	9.7
Mar, Apr, May	6801	10121	60%	2.21	78.00	6.6
Jun, Jul, Aug	2154	4520	68%	2.35	78.00	8.7
Sep, Oct, Nov	1749	2252	56%	2.38	78.00	6.7

Total Uranium is the sum of U-233, 234 and U-238

As stated previously, it should be noted that the above predicted values are seasonal averages. Actual discrete water-quality measurements would vary in time. For example, declining constituent concentrations and activities for ITS waters would result in improved water quality for the resultant surface water in North Walnut Creek. Conversely, during periods of low influent surface water flows, resultant water quality in North Walnut Creek will approach that of the ITS discharge water. Therefore, the resultant predicted water quality for North Walnut Creek depends on future variations in water quality and quantity for both the ITS and influent surface water. Figures 2-1 through 2-4 show graphical representations of the values given in Table 2-2.

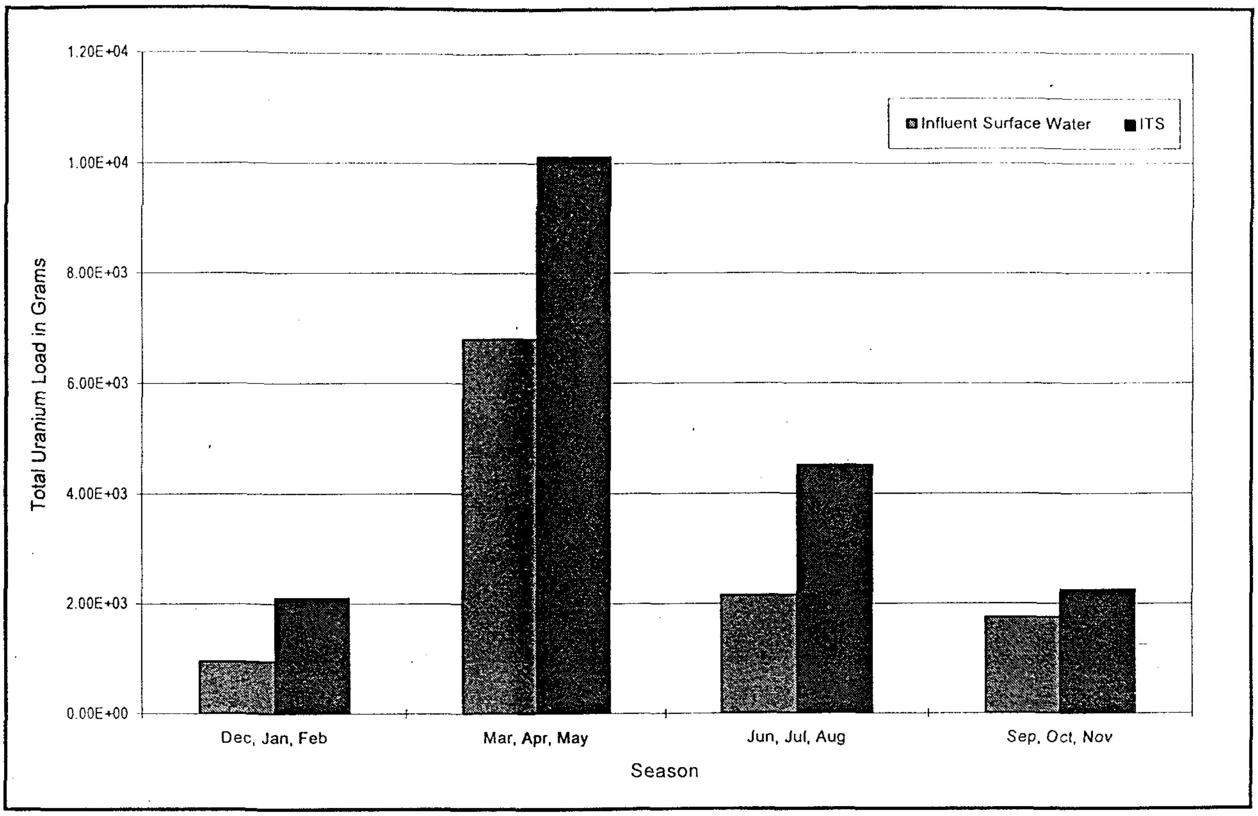

Figure 2-1 Predicted Seasonal Total Uranium Loads

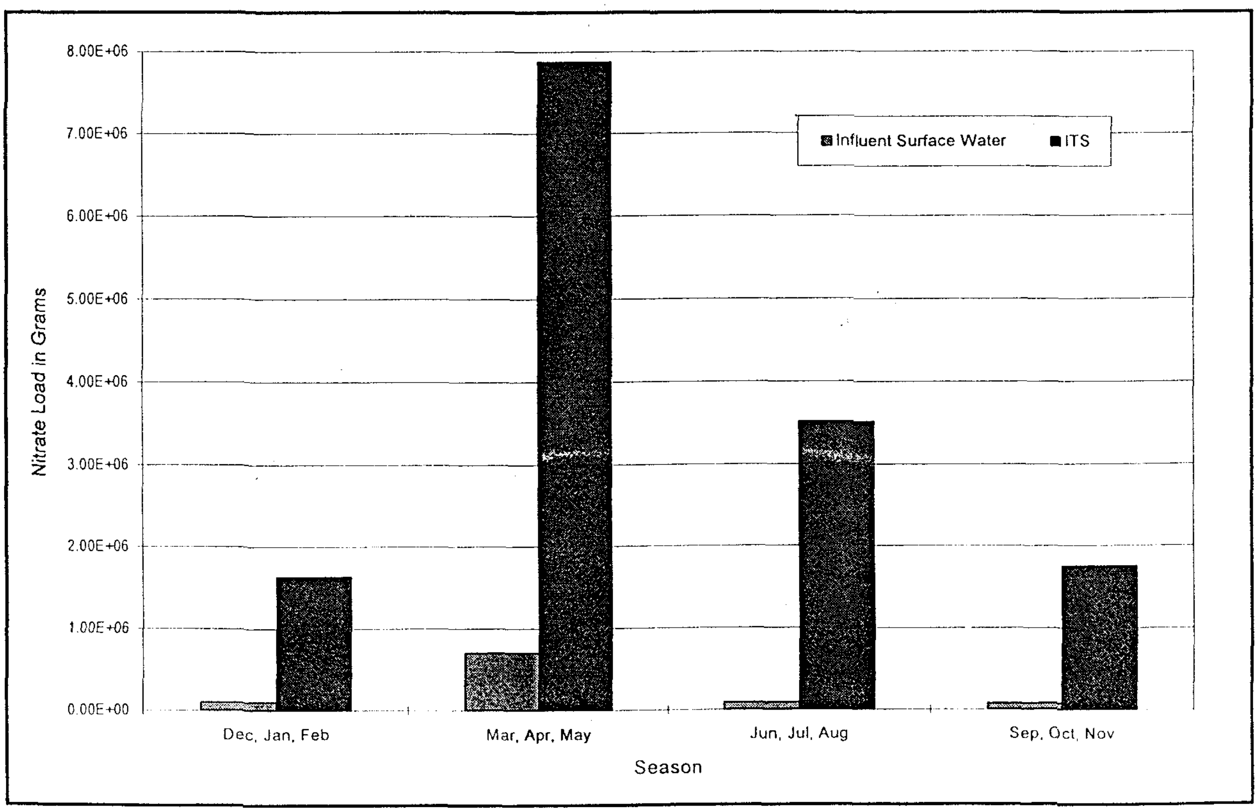

Figure 2-2 Predicted Seasonal Total Nitrate Loads

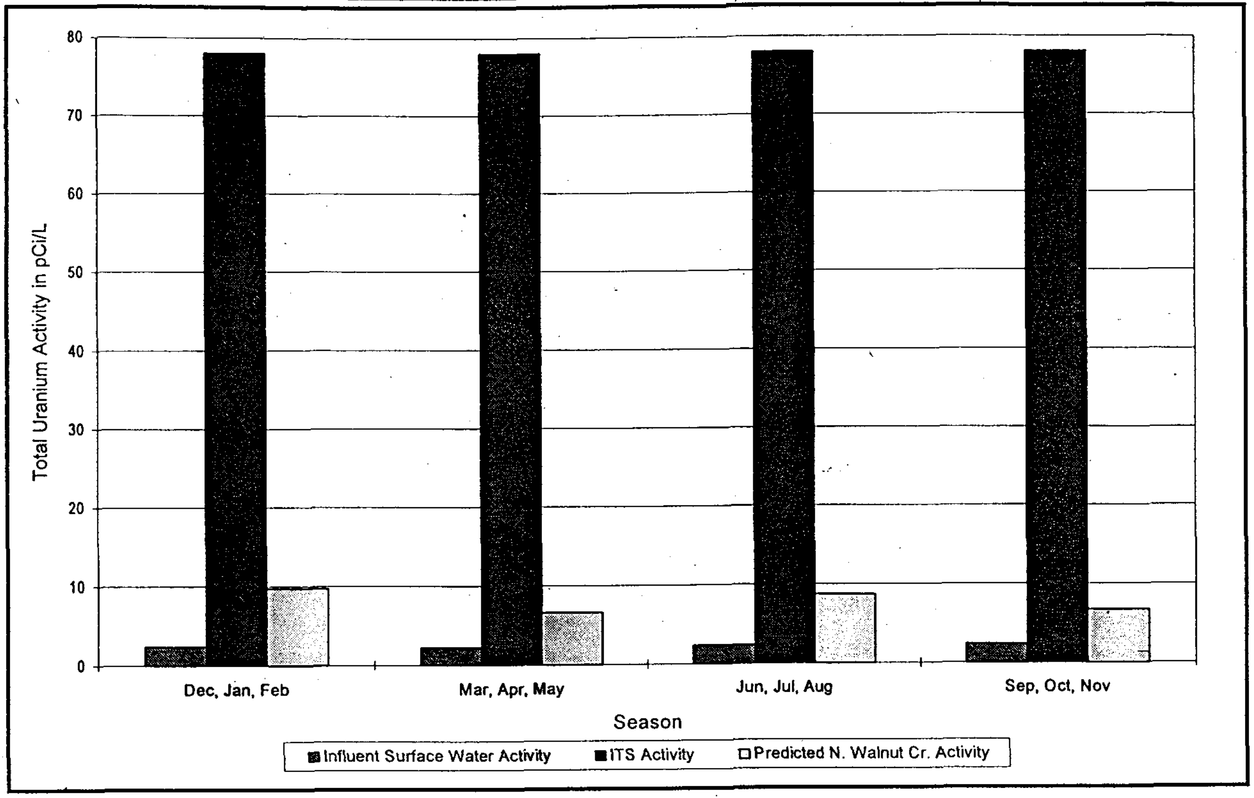

Figure 2-3 Predicted Seasonal Total Uranium Activities

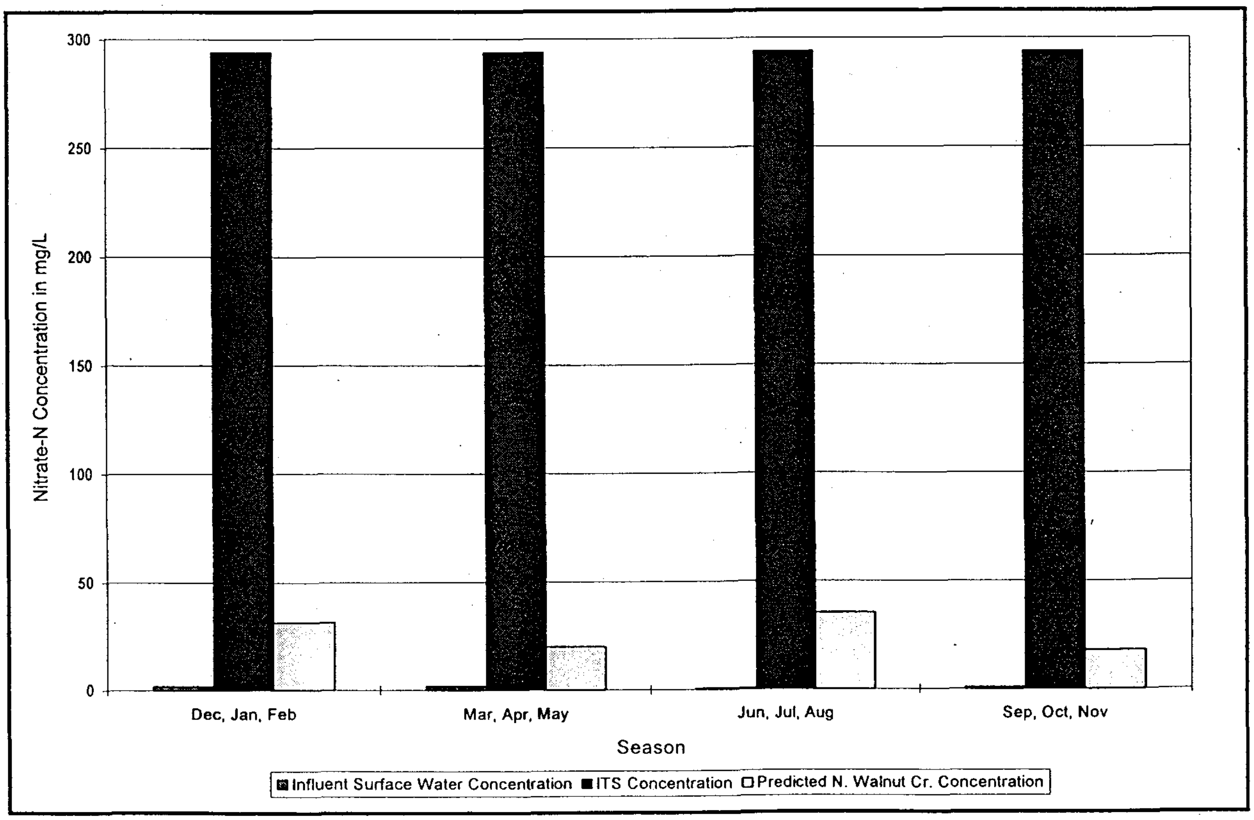

Figure 2-4 Predicted Seasonal Total Nitrate – N Concentrations

2.3 CALCULATION OF AVERAGE SEASONAL LOAD CONTRIBUTIONS

This section provides details regarding the development of seasonal values for uranium and nitrate used in the evaluation of loading in North Walnut Creek. In the following subsections, two important quantities are discussed: load and yield. Load is an intensive variable that may be considered to be a mass flow with units of mass per unit time (e.g., grams/day). Yield is an extensive variable which may be given in terms of mass or volume (e.g., acre-feet, liters, grams). Understanding these terms is important in the following discussion.

2.3.1 Influent North Walnut Creek Surface Water

Evaluation of North Walnut Creek surface water is intended to provide representative water-quality values for influent surface water (receiving waters) that would be combined with a proposed ITS discharge. The resulting water quality for North Walnut Creek would be a combination of influent surface water and ITS water.

U-233, 234 and U-238

The results of surface water samples from gauging stations SW093 and GS13 from the period 1991 to 1995 were used to calculate a relationship between stream discharge and U-233, 234 and U-238 loads. These locations were chosen to give a large population of data points and are representative of water quality in North Walnut Creek for current ITS operations. The data indicate that the uranium activities for these sites are not significantly influenced by groundwater contributions which may not be contained by the ITS. The U-233, 234 and U-238 loads are associated with the sample time (for grabs) or sample period for samples composited over time. Load units were converted to be similar in magnitude to the stream discharge, and then the discharge was regressed against the loads to obtain regression equations for fitting the curves. The curves shown in Figures 2-5 and 2-6 describe the load/discharge relationship for North Walnut Creek receiving waters for U-233, 234 and U-238, respectively.

Monthly average constituent loads were calculated based on the stormwater discharge record collected at gauging stations GS13 and SW093. Discharge records for Water Years 1993 - 1996 (WY93-WY96) were used. Discharge record prior to WY93 is of poor quality. The following protocol was used to calculate the monthly average constituent loads.

1. For each day where the mean daily discharge rate was known, a load (in grams/day) was calculated for each constituent using the regression models in Figures 2-5 and 2-6.

2. These estimated daily loads were then used to calculate an average daily load for each day of each month. The estimated average daily loads were then multiplied by the number of days in each month to obtain the estimated average monthly loads (grams/month) for each constituent.

3. These loads were then summed seasonally to calculate average seasonal yields (grams).

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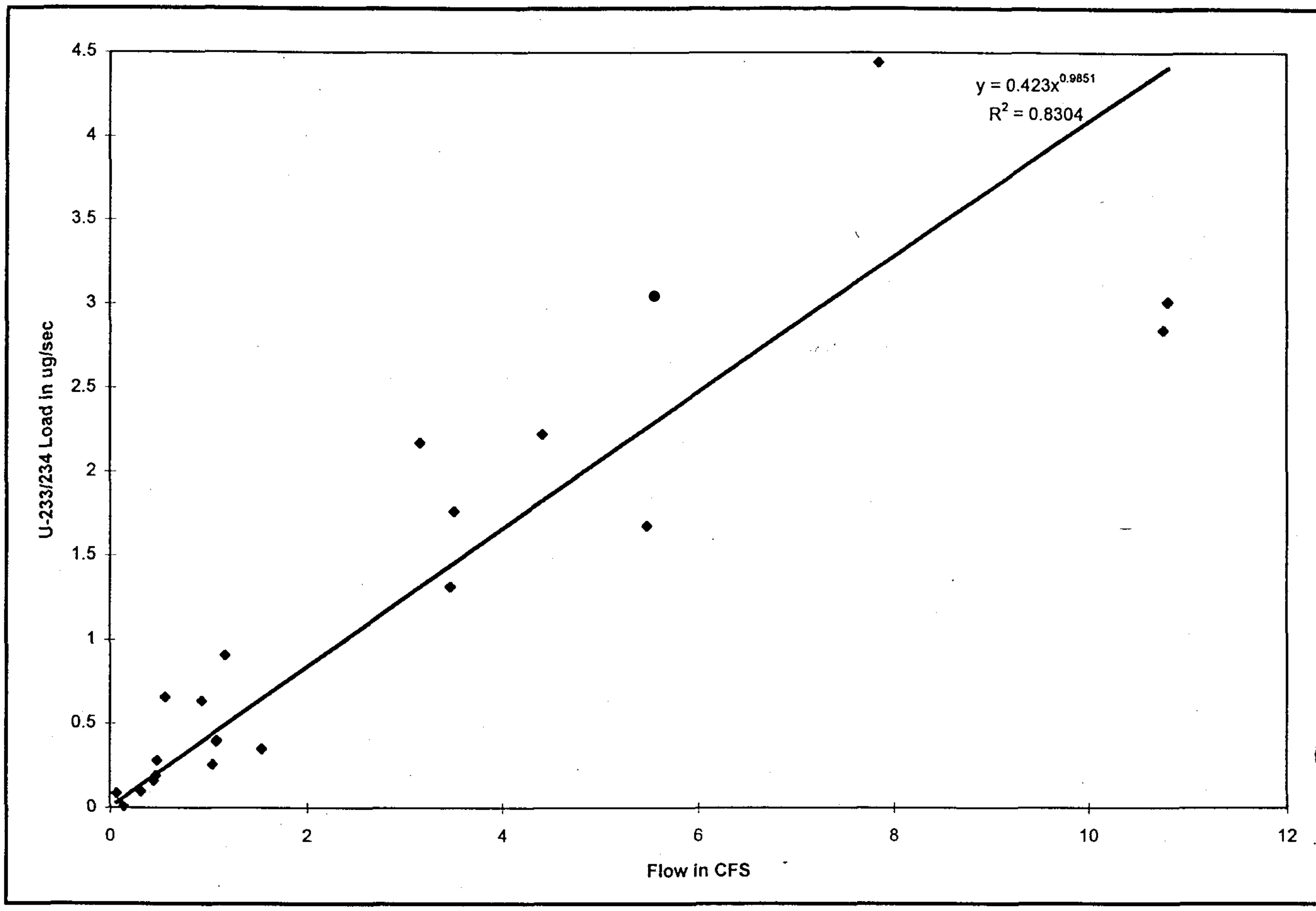

Figure 2-5 Variation of Flow and U-233, 234 Load for North Walnut Creek

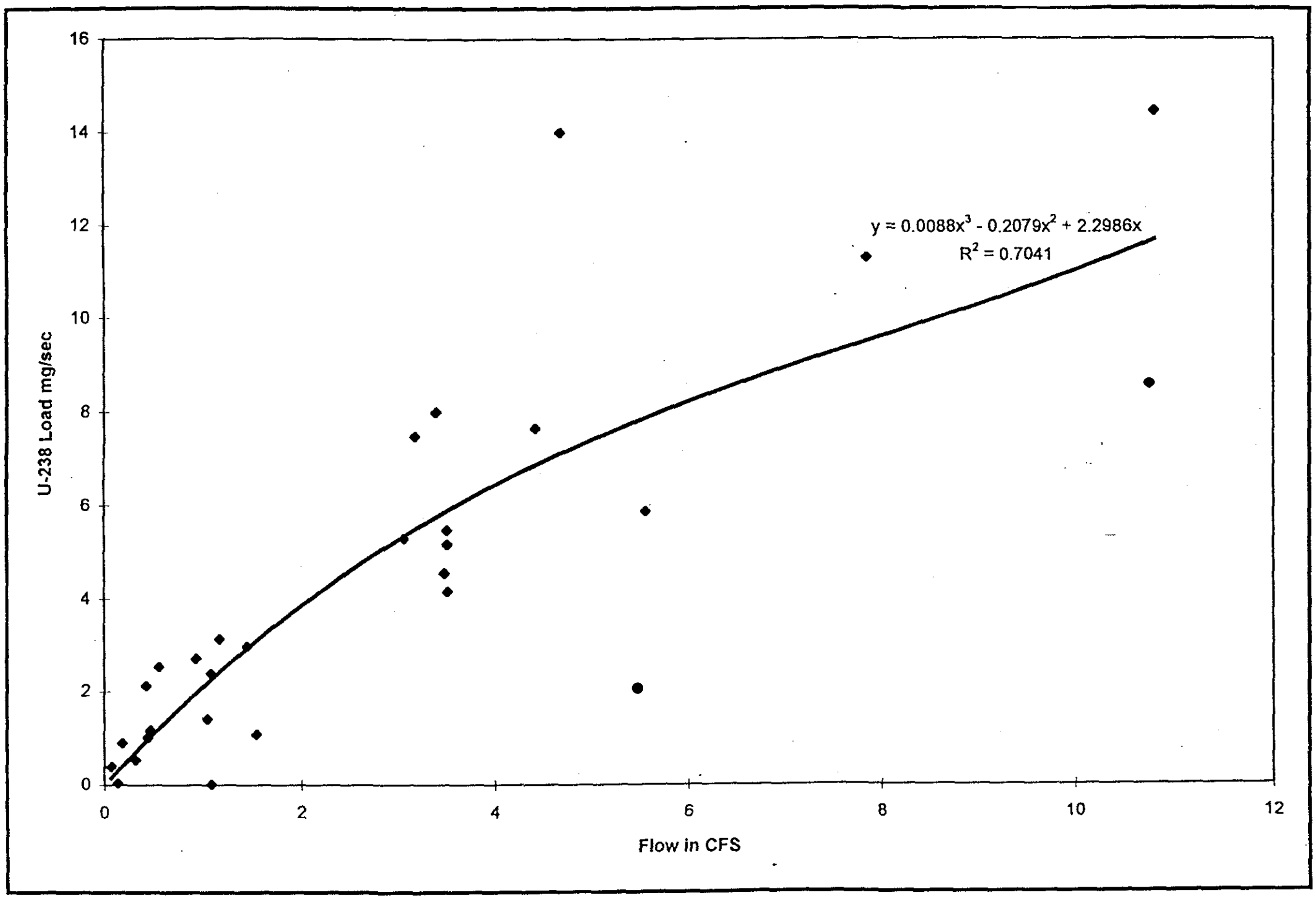

Figure 2-6 Variation of Flow and U-238 Load for North Walnut Creek

Nitrate

Using all available surface water sample results from Pond A-3 effluent from the period of 1992 to 1995, monthly average nitrate as N concentrations in milligrams per liter (NO^-_3 as N mg/L) were calculated as shown in Table 2-3. Pond A-3 was assumed to be representative of A-Series influent waters because it receives all A-Series influent waters. Pond A-3 also has a slightly higher nitrate - N concentration than A-Series influent water (1.06 from the period of A-3 for 1/14/92 to 1/5/96; 0.79 for influent for 1994 to 1995). Pond A-3 shows no change in nitrate concentration over time, while influent waters show a decline from 1990 to 1995. Hence, results from the years 1994 and 1995 are considered representative of current conditions for A-Series influent waters, and the Pond A-3 average nitrate concentration is used as a conservative measure. Additionally, the use of the Pond A-3 concentrations accounts for bioassimilation. These monthly average nitrate - N concentrations were then multiplied by the average monthly discharge rate (measured at SW093 and GS13) and converted to suitable units to obtain average total nitrate loads (in grams/month) for each month. These loads were then summed seasonally to calculate average seasonal yields (grams).

Table 2-3 Monthly Average Pond A-3 Nitrate as N Concentrations

Month	Average Nitrate as N Concentration in mg/L
January	1.93
February	2.48
March	2.16
April	1.79
May	1.35
June	0.83
July	0.37
August	0.15
September	0.10
October	0.63
November	1.40
December	1.02

2.3.2 ITS Waters

U-233, 234 and U-238

Using available results from ITS water samples at station SW095 (ITS Central Sump) from the period of 1990 to 1995, average U-233, 234 and U-238 activities (pCi/L) were calculated. Only five samples were available for this calculation. Monthly average activities for each constituent were assumed to be the same for all months[1] because of the small number of samples that are available, as shown in Table 2-4.

Table 2-4 Average Uranium Activities for ITS Waters

Average U-233, 234 Activity pCi/L	Average U-238 Activity pCi/L
47.9	30.1

[1] Some months had no samples, therefore average monthly values could not be obtained for ITS waters. Therefore, an average monthly U-233, 234 activity of 47.66 pCi/L was assumed for all months; an average monthly U-238 activity of 29.75 pCi/L was assumed for all months.

Assuming that the ITS is left in place (i.e., all the french drain components are left in place ungrouted), collected water (groundwater and surface water that enter the system) would continue to flow with gravity to the ITS Central Sump. Under this proposed action, the ITS Central Sump is allowed to overflow or the water is directly pump discharged to receiving North Walnut Creek surface water. Estimated monthly average ITS water discharge rates can be calculated as follows:

1. An average annual total ITS water yield of 3 mgal was assumed (DOE February 1994).

2. Using daily discharge data collected at the ITS Central Sump for 1994 and 1995, a monthly percent contribution of yield was calculated, and is shown in Table 2-5. Although each year does not give a total yield of 3 mgal, it was assumed that the 2 years give a representative monthly flow distribution regardless of the total discharges. These percentages were then multiplied by the 3 mgal to calculate average monthly ITS water yield in gallons.

Using the monthly ITS water yields, the monthly average constituent activities, and the associated activity-to-mass ratios (DOE 1980), an estimated average monthly ITS load was calculated for each constituent.

These loads were then summed seasonally to calculate *average* seasonal constituent yields.

Table 2-5 ITS Daily Discharge Data: Measured at ITS Central Sump

	Volume for 1994 Gallons	Volume for 1995 Gallons	Average Monthly Percent Contribution
January	120120	80190	3.34%
February	140030	135000	4.35%
March	317240	143000	8.08%
April	518210	958026	21.08%
May	355300	1545737	24.11%
June	217470	869000	13.92%
July	124520	252000	5.30%
August	154660	127490	4.57%
September	98230	138932	3.53%
October	106590	128700	3.59%
November	167090	118470	4.73%
December	109450	103840	3.38%
Total	2428910	4600385	100%

Nitrate

Using the 10 most recent available results from ITS water samples, average nitrate as N concentrations (NO^{-}_{3} as N mg/L) were calculated. Nine of the samples were taken at the surface water sampling location (SW095); the remaining sample was taken at the MSTs. Samples were not distributed adequately by month to determine monthly concentration variations, and the average concentration was assumed to be the same for all months. These monthly average nitrate - N concentrations were then multiplied by the corresponding monthly ITS water yield, and converted to convenient units, to obtain average monthly total nitrate yields in grams. The average monthly total nitrate yields were then summed seasonally to calculate average seasonal total nitrate yields.

Table 2-6 Average Nitrate as N Concentration for ITS Waters

Average Nitrate as N Concentration mg/L
294.0

2.4 CALCULATION OF AVERAGE SEASONAL ACTIVITIES AND CONCENTRATIONS

The average predicted seasonal U-233, 234 and U-238 activities and nitrate - N concentrations in North Walnut Creek, which could result from the discharge of ITS water to the creek, were calculated via the following protocol.

2.4.1 Influent North Walnut Creek Surface Water

Evaluation of North Walnut Creek surface water is intended to provide representative water-quality values for influent surface water (receiving waters), which would be combined with a proposed ITS discharge. The resulting water quality for North Walnut Creek would be a combination of influent surface water and ITS water.

U-233, 234 and U-238

1. The average monthly yields (in grams) for each constituent were converted to pCi using the appropriate activity/mass ratio (DOE 1980).

2. The average monthly activities (pCi) were then divided by the corresponding average monthly North Walnut Creek surface water yield and converted to convenient units to obtain an average monthly activity in units of pCi/L.

3. These activities were then averaged seasonally to calculate average seasonal constituent activities in pCi/L.

Nitrate

Monthly average nitrate as N concentrations for influent North Walnut Creek surface water were calculated. These monthly averages were then averaged seasonally to obtain seasonal nitrate as N concentrations.

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2.4.2 ITS Waters

The average predicted seasonal U-233, 234 and U-238 activities and nitrate concentrations for the ITS were calculated by the following protocol.

U-233, 234 and U-238

Using available results for ITS water samples from station SW095 (ITS Central Sump) from the period 1990 to 1995, average U-233, 234 and U-238 activities (pCi/L) were calculated. Only eight samples were available for this calculation. Monthly average U-233, 234 and U-238 activities were assumed to be the same for all months due to the small number of samples that are available.

Nitrate

The average nitrate as N concentration for ITS water was calculated. This average was assumed to be the same for all seasons because samples were not distributed adequately to determine seasonal variations.

2.4.3 Predicted North Walnut Creek Concentrations and Activities

The predicted seasonal average activities and concentrations for North Walnut Creek, just below the proposed ITS discharge point, were calculated by volume weighting the corresponding seasonal averages for the influent surface water and the ITS.

Equation (2-1)

$$\text{Predicted Walnut Cr. Concentration} = \frac{[(\text{Influent Conc.})(\text{Influent Volume})] + [(\text{ITS Conc.})(\text{ITS Volume})]}{[(\text{Influent Volume}) + (\text{ITS Volume})]}$$

$$\text{Predicted Walnut Cr. Activity} = \frac{[(\text{Influent Act.})(\text{Influent Volume})] + [(\text{ITS Act.})(\text{ITS Volume})]}{[(\text{Influent Volume}) + (\text{ITS Volume})]}$$

2.5 BACKGROUND URANIUM AND NITRATE ACTIVITIES AND CONCENTRATIONS

The Background Geochemical Characterization Report (BGCR) lists statistical summaries for uranium activities and nitrate concentrations for stream and seep waters (EG&G 1993). Water samples collected from streams and seeps in the Rock Creek drainage and the western portion of the Woman Creek drainage were not impacted by Site activities, thus representing background water quality. Summary statistics for BGCR results for uranium and nitrate are listed in Table 2-7. These data are reproduced to provide a point of reference for evaluating ITS and North Walnut Creek water-quality values.

Table 2-7 Summary Statistics for Uranium and Nitrate Data

Stream/ Seep	Constituent	Samples (N)	% Non-Detected	Mean	Standard Deviation	Units
Stream Data	Total Uranium-233,234	79	NA	0.49	0.55	pCi/L
Stream Data	Total Uranium-238	55	NA	0.36	0.43	pCi/L
Stream Data	Total Nitrate	153	42	0.52	0.77	mg/L
Seep Data	Total Uranium-233,234	33	NA	0.64	1.29	pCi/L
Seep Data	Total Uranium-238	28	NA	0.64	1.21	pCi/L
Seep Data	Total Nitrate	53	40	1.14	1.84	mg/L

Note: Normal distribution assumed.
pCi/L = picocuries per liter
µg/L = micrograms per liter
NA = Nondetections not applicable to radiochemical data

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3.0 WATER-QUALITY DATA TABLES

Water-quality data used to support the evaluations presented in this management plan are shown in Tables 3-1 through 3-10.

3.1 NITRATE DATA

Table 3-1 Nitrate as N Sample Results from Sampling Location SW095 (ITS Central Sump) and MSTs

SW095 Sample Number	Sample Date	Result: mg/L nitrate as N
SW70165JE	11/8/93	366
SW70173JE	2/15/94	337
SW70196JE	5/9/94	310.5
SW70221JE	8/16/94	370
SW70285JE	11/7/94	320
SW70286JE	2/7/95	345.5
SW70287JE	5/4/95	195.5
SW00432JE	5/16/95	276.5
VW21753JE	6/9/95	57*
Modular Storage Tanks	9/29/95	357.5
Average		294

*This sample appears to be an extreme value. However, this sample was likely taken during high flows in the ITS, and significant dilution is expected to have occurred. In fact, this sample may be more representative of ITS nitrate concentrations on a volume-weighted basis. Figure 3-1 shows an apparent relationship between ITS discharge and declining concentration for samples where ITS discharge volumes were available. Therefore, this sample was retained in the analysis because the result cannot be confirmed as invalid.

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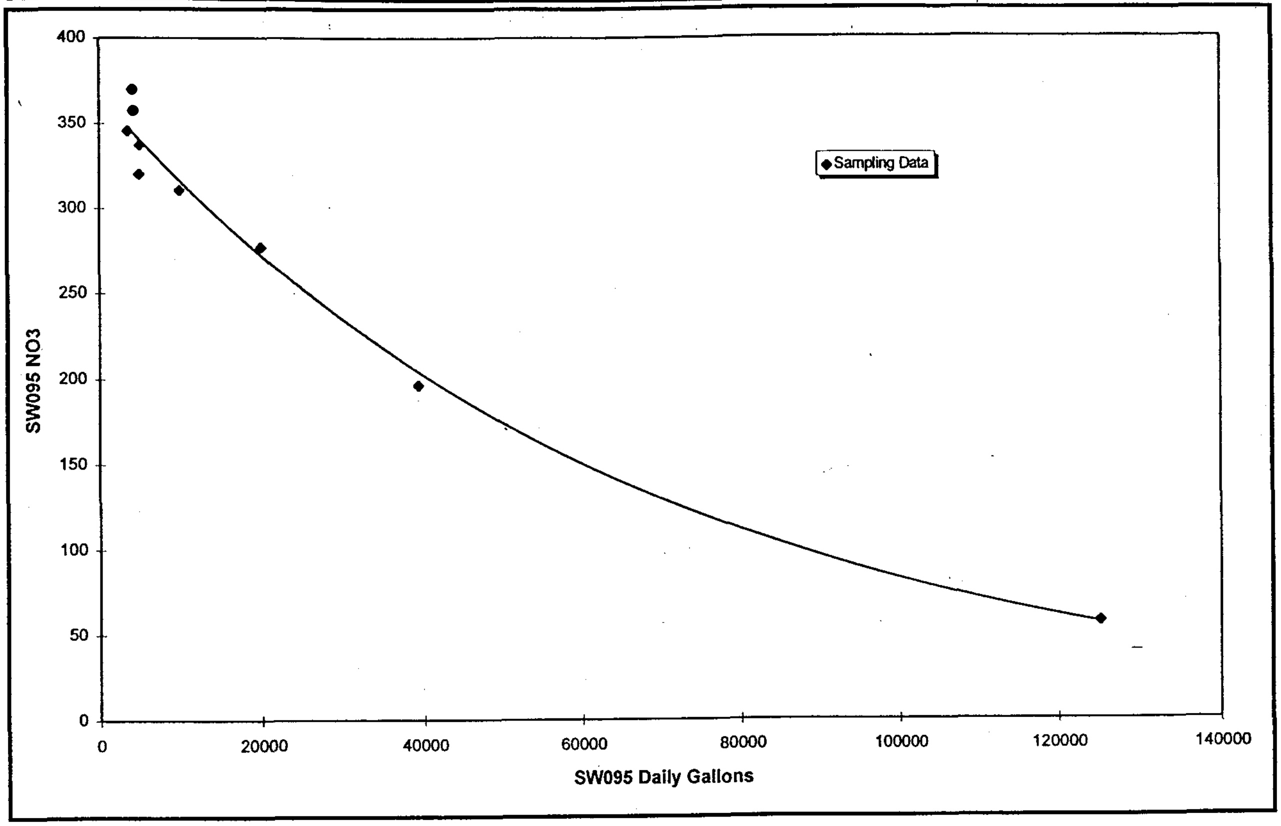

Figure 3-1 Variation of Nitrate Concentration with Daily Discharge Volumes at the ITS Central Sump

Table 3-2 Nitrate as N Sample Results from Pond A3 and Pond A-3 Effluent

A-3, A-3EFF Sample Number	Sample Date	Result: mg/L nitrate as N
NP59145WC	1/14/92	1.52
NP59594WC	2/22/92	3.8
NP59607WC	2/23/92	3.65
NP59619WC	2/24/92	3.86
NP59633WC	2/25/92	3.64
NP59646WC	2/26/92	3.51
NP59661WC	2/27/92	3.17
NP59885WC	3/13/92	2.32
NP59894WC	3/14/92	2.17
NP59905WC	3/15/92	2.13
NP59913WC	3/16/92	2.14
NP59929WC	3/17/92	2.19
NP59943WC	3/18/92	2.32

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A-3, A-3EFF Sample Number	Sample Date	Result: mg/L nitrate as N
NP59954WC	3/19/92	2.32
NP59977WC	3/20/92	2.23
NP59989WC	3/21/92	1.86
NP60003WC	3/22/92	2.14
NP60015WC	3/23/92	2.33
NP60031WC	3/24/92	2.16
NP60040WC	3/25/92	2.17
NP60057WC	3/26/92	2.22
NP60072WC	3/27/92	2.22
NP60082WC	3/28/92	1.7
NP60098WC	3/29/92	1.99
NP60109WC	3/30/92	2.21
NP60126WC	3/31/92	2.3
NP60137WC	4/1/92	2.25
NP60158WC	4/2/92	1.97
NP60182WC	4/3/92	3.28
NP60419WC	4/21/92	2.48
NP60524WC	4/29/92	2.03
NP60522WC	4/30/92	2.36
NP60531WC	5/1/92	2.5
NP60541WC	5/2/92	2.22
NP60549WC	5/3/92	2.2
NP60560WC	5/4/92	0.02
NP60997WC	6/13/92	0.54
NP61005WCD	6/13/92	0.56
NP61010WC	6/14/92	0.75
NP61018WC	6/15/92	0.82
NP61031WC	6/16/92	0.87
NP61044WC	6/17/92	0.73
NP61056WC	6/18/92	0.74
VW00192WC	8/1/92	0.16

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A-3, A-3EFF Sample Number	Sample Date	Result: mg/L nitrate as N
	8/2/92	0.28
VW00213WC	8/3/92	0.24
VW00220WC	8/3/92	0.26
VW00227WC	8/4/92	0.25
VW00243WC	8/5/92	0.28
VW01346WC	11/11/92	1.4
VW01357WC	11/12/92	1.4
VW01378WC	11/13/92	1.4
VW02007WC	1/19/93	4.4
VW02024WC	1/20/93	0.66
VW02034WC	1/21/93	2.7
VW02045WC	1/22/93	2.5
VW00385JE	4/7/93	1.81
VW00387JE	4/7/93	1.81
VW00391JE	4/8/93	1.85
VW00404JE	4/9/93	1.68
VW00413JE	4/10/93	1.65
VW00427JE	4/11/93	1.54
VW00438JE	4/12/93	1.52
VW00448JE	4/13/93	1.75
VW00457JE	4/14/93	1.77
VW00487JE	4/15/93	1.7
VW00505JE	4/16/93	1.84
VW00513JE	4/17/93	1.34
VW00527JE	4/18/93	1.34
VW00536JE	4/19/93	1.52
VW00917JE	5/19/93	1.45
VW00922JE	5/20/93	1.43
VW00937JE	5/21/93	1.37
VW01317JE	6/24/93	0.79
VW01330JE	6/25/93	0.83

A-3, A-3EFF Sample Number	Sample Date	Result: mg/L nitrate as N
VW01338JE	6/26/93	0.82
VW01349JE	6/27/93	0.82
VW01358JE	6/28/93	0.78
VW01364JE	6/28/93	0.79
VW01366JE	6/28/93	0.79
VW01373JE	6/29/93	0.74
VW02928JE	12/13/93	0.94
VW02931JE	12/14/93	0.95
VW02935JE	12/15/93	1.06
VW02942JE	12/15/93	1.06
VW02944JE	12/15/93	1.1
VW02947JE	12/16/93	1.01
VW02956JE	12/17/93	1.02
VW06890JE	2/14/94	3.47
VW06904JE	2/15/94	1.35
VW06915JE	2/16/94	1.57
VW06925JE	2/17/94	1.47
VW06931JE	2/17/94	1.46
VW06936JE	2/18/94	1.61
VW07555JE	4/13/94	1.67
VW07560JE	4/14/94	1.72
VW07567JE	4/14/94	1.68
VW07569JE	4/14/94	1.8
VW07573JE	4/15/94	1.72
VW07585JE	4/16/94	1.7
VW07600JE	4/17/94	1.62
VW07612JE	4/18/94	1.58
VW07622JE	4/19/94	1.58
VW07634JE	4/20/94	1.5
VW07647JE	4/21/94	1.55
VW07671JE	4/22/94	1.4

A-3, A-3EFF Sample Number	Sample Date	Result: mg/L nitrate as N
VW08038JE	5/23/94	0.51
VW08052JE	5/24/94	0.79
VW08066JE	5/25/94	0.92
VW08077JE	5/26/94	0.82
VW08088JE	5/27/94	0.71
VW08456JE	6/28/94	0.05
VW08457JE	6/28/94	0.05
VW08459JE	6/28/94	0.03
VW08464JE	6/29/94	0.14
VW08477JE	6/30/94	0.13
VW08487JE	7/1/94	0.12
VW08906JE	8/8/94	0.05
VW08922JE	8/9/94	0.05
VW08933JE	8/10/94	0.05
VW08943JE	8/10/94	0.05
VW09481JE	9/28/94	0.1
VW09494JE	9/29/94	0.09
VW09505JE	9/30/94	0.1
VW20099JE	1/11/95	1.98
VW20108JE	1/12/95	1.73
VW20117JE	1/13/95	1.77
VW20431JE	2/15/95	1.46
VW20445JE	2/16/95	1.57
VW20454JE	2/17/95	1.57
VW21078JE	4/21/95	1.97
VW21178JE	5/3/95	2.24
VW21380JE	5/20/95	1.14
VW21444JE	5/24/95	1.19
VW21458JE	5/25/95	1.6
VW21474JE	5/26/95	1.6
VW21487JE	5/27/95	1.2

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A-3, A-3EFF Sample Number	Sample Date	Result: mg/L nitrate as N
VW21505JE	5/28/95	1.7
VW21520JE	5/29/95	1.4
VW21532JE	5/30/95	1.5
VW21553JE	5/31/95	1.2
VW21566JE	6/1/95	1.1
VW21581JE	6/2/95	1.1
VW21594JE	6/3/95	1.2
VW21613JE	6/4/95	1.2
VW21628JE	6/5/95	1.1
VW21644JE	6/6/95	1.15
VW21658JE	6/7/95	1.1
VW21674JE	6/8/95	1.2
VW21685JE	6/9/95	1.1
VW21698JE	6/10/95	1.1
VW21720JE	6/11/95	1.4
VW21740JE	6/12/95	1.2
VW21760JE	6/13/95	1.05
VW21776JE	6/14/95	1.3
VW21788JE	6/15/95	1.1
VW22064JE	7/11/95	0.42
VW22071JE	7/11/95	0.44
VW22073JE	7/11/95	0.42
VW22078JE	7/12/95	0.43
VW22087JE	7/13/95	0.41
VW22095JE	7/14/95	0.34
VW22375JE	8/14/95	0.05
VW22384JE	8/15/95	0.1
VW22396JE	8/16/95	0.09
VW22873JE	10/16/95	0.64
VW22877JE	10/17/95	0.62
VW22883JE	10/18/95	0.63

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A-3, A-3EFF Sample Number	Sample Date	Result: mg/L nitrate as N
VW22887JE	10/18/95	0.64
VW22893JE	10/19/95	0.63
VW22897JE	10/20/95	0.62
VW23379JE	1/2/96	1.95
VW23384JE	1/3/96	1.3
VW23390JE	1/4/96	1.4
VW23397JE	1/5/96	1.3

Table 3-3 Nitrate as N Sample Results from Pond B-5 and Pond B-5 Effluent

B-5, B-5EFF Sample Number	Sample Date	Result: mg/L nitrate as N
NP59038WC	1/6/92	4.03
NP59207WC	1/20/92	3.6
NP59213WCD	1/20/92	0.02
NP59296WC	1/27/92	2.54
NP59366WC	2/3/92	3.3
NP59446WC	2/10/92	4.05
NP59523WC	2/17/92	4.01
NP59623WC	2/24/92	4.67
NP59714WC	3/2/92	4.05
NP50558WC	3/10/92	3.7
NP50561WC	3/11/92	2.9
NP59815WC	3/12/92	2.41
NP59921WC	3/16/92	2.43
NP60019WC	3/23/92	1.66
NP60114WC	3/30/92	2.32
NP60221WC	4/6/92	2.21
NP60318WC	4/13/92	2.88
NP60406WC	4/20/92	2.73
NP60482WC	4/27/92	3.51
NP60564WC	5/4/92	3.55
NP60699WC	5/18/92	3.33

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3.2 URANIUM DATA

Table 3-4 Uranium Sample Results (pCi/L) from Sampling Location SW095 (ITS Central Sump)

SW095 Sample Number	Sample Date	Uranium-233,-234	Uranium-238
SW09590001	1/26/90	57.64	34.39
SW09590003	3/16/90	58.19	36.63
SW00157WC	6/26/90	58.72	39.68
SW01696WC	10/28/91	51	31
VW21753JE	6/9/95	14.1*	8.765*
Average		47.9	30.1

*The sample appears to be incongruous with the other sample results. However, this result was retained in the analysis for the reasons discussed in footnote to the Nitrate Data section.

Table 3-5 Uranium Sample Results (pCi/L) from Pond A3 and Pond A-3 Effluent

A-3, A-3EFF Sample Number	Sample Date	Uranium-233,-234	Uranium-238
VW00386JE	4/6/93	1.30	1.72
VW00424JE	4/10/93	1.58	1.83
VW00524JE	4/17/93	1.01	1.49
VW00918JE	5/19/93	1.91	2.50
VW02929JE	12/13/93	0.08	0.06
VW06897JE	2/14/94	1.61	1.80
VW07554JE	4/13/94	2.32	2.59
VW07597JE	4/16/94	1.98	2.24
VW08014JE	5/21/94	1.49	1.77
VW08460JE	6/28/94	1.38	1.73
VW08914JE	8/8/94	1.50	1.99
VW09489JE	9/28/94	1.89	2.29
VW21080JE	4/22/95	1.00	1.18
VW21113JE	4/26/95	1.20	1.45
VW21134JE	4/29/95	1.19	1.38
VW21363JE	5/17/95	0.83	0.90
VW21396JE	5/20/95	1.27	1.43

B-5, B-5EFF Sample Number	Sample Date	Result: mg/L nitrate as N
NP60766WC	5/25/92	5.31
NP50604WC	5/27/92	3.25
NP60841WC	6/1/92	2.59
NP50611WC	6/3/92	3.3
NP60928WC	6/8/92	3.43
NP61022WC	6/15/92	2.93
NP61102WC	6/22/92	3.46
NP61172WC	6/29/92	2.81
NP61238WC	7/6/92	3.52
NP61314WC	7/13/92	3.54
VW00024WC	7/20/92	4.28
VW00127WC	7/27/92	3.36
VW00214WC	8/3/92	2.58
VW00466WC	8/24/92	2.5
NP50685WC	9/8/92	2.3
NP50725WC	11/15/92	2
SW50002JE	3/8/93	0.02
SW50068JE	7/1/93	2.2
VW02033JE	9/7/93	3.02
VW02477JE	10/26/93	4.03
VW02993JE	12/20/93	3
VW07303JE	3/23/94	2.19
VW07305JE	3/24/94	3.06
VW07354JE	3/25/94	2.66
VW07367JE	3/29/94	3.38
VW07709JE	4/26/94	3.73
VW08916JE	8/8/94	1.66
VW21439JE	5/23/95	1.62
VW21549JE	5/30/95	0.051
Average		**2.91**

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A-3, A-3EFF Sample Number	Sample Date	Uranium-233,-234	Uranium-238
VW21499JE	5/27/95	1.26	1.31
Average		**1.38**	**1.65**

Table 3-6 Uranium Sample Results (pCi/L) from Pond B-5 and Pond B-5 Effluent

B-5, B-5EFF Sample Number	Sample Date	Uranium-233,-234	Uranium-238
NP50685WC	9/8/92	0.24	0.26
NP50725WC	11/15/92	0.36	0.29
SW50062JE	5/25/93	0.68	0.39
SW50068JE	7/1/93	0.38	0.38
VW02033JE	9/7/93	0.34	0.27
VW02452JE	10/22/93	0.24	0.20
SW50111JE	12/9/93	0.30	0.32
SW50112JE	12/16/93	1.34	0.99
VW02993JE	12/20/93	0.33	0.29
SW50114JE	1/6/94	0.32	0.28
SW50116JE	2/10/94	0.27	0.23
SW50117JE	2/15/94	0.27	0.19
VW06980JE	2/22/94	0.29	0.27
SW50118JE	3/3/94	0.38	0.30
SW50119JE	3/10/94	0.41	0.28
SW50120JE	3/17/94	0.42	0.36
VW07304JE	3/23/94	0.79	0.68
VW07354JE	3/25/94	1.78	1.38
SW50121JE	4/19/94	0.65	0.51
VW07709JE	4/26/94	0.61	0.52
SW50122JE	5/5/94	0.68	0.60
SW50124JE	5/24/94	0.86	0.74
SW50125JE	6/9/94	0.84	0.67
VW08298JE	6/16/94	0.72	0.66
VW08662JE	7/14/94	0.66	0.55
VW08687JE	7/21/94	0.62	0.56

B-5, B-5EFF Sample Number	Sample Date	Uranium-233,-234	Uranium-238
VW08918JE	8/4/94	0.52	0.46
VW08916JE	8/8/94	0.58	0.50
VW09083JE	8/25/94	0.52	0.51
VW09147JE	9/1/94	0.55	0.44
VW09408JE	9/22/94	0.48	0.40
VW09495JE	9/29/94	0.48	0.40
VW09638JE	10/13/94	0.37	0.34
VW09704JE	10/20/94	0.40	0.34
VW09880JE	11/3/94	0.36	0.33
VW09959JE	11/10/94	0.37	0.36
VW10008JE	11/14/94	0.46	0.38
VW10172JE	12/1/94	0.43	0.37
VW10239JE	12/8/94	0.63	0.57
VW10479JE	12/29/94	0.62	0.53
VW20040JE	1/5/95	0.51	0.50
VW20241JE	1/26/95	0.40	0.39
VW20306JE	2/2/95	0.56	0.47
VW20563JE	3/2/95	0.57	0.48
VW20904JE	4/6/95	0.67	0.64
VW20961JE	4/13/95	0.70	0.63
VW21111JE	4/26/95	0.90	0.87
VW21116JE	4/27/95	0.89	0.96
VW21137JE	4/29/95	1.09	1.03
VW21227JE	5/6/95	1.20	1.15
VW21345JE	5/17/95	1.44	1.34
VW21346JE	5/17/95	1.28	1.14
VW21395JE	5/20/95	1.08	1.04
VW21545JE	5/27/95	1.54	1.35
VW21988JE	6/29/95	1.75	1.64
VW22036JE	7/6/95	1.40	1.32
VW22088JE	7/13/95	1.38	1.26

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B-5, B-5EFF Sample Number	Sample Date	Uranium-233,-234	Uranium-238
VW22205JE	7/27/95	1.24	1.10
Average		**0.69**	**0.61**

Table 3-7 Uranium-233,234 Data for North Walnut Creek

Site	Date	Sample Time	Average of Flow (CFS)	Average of U-233,234 (pCi/L)
GS13	4/30/91	3:21:00 PM	3.505	1.1
	10/26/92	2:15:00 PM	0.133	0.15
	4/5/93	NA	0.553	2.6
	5/17/93	3:25:00 PM	1.543	0.499
	5/17/93	NA	4.415	1.1
	9/2/93	1:15:00 PM	0.441	0.801
	9/5/93	2:30:00 PM	0.068	2.773
GS13	9/5/93	11:25:00 AM	0.312	0.688
	9/13/93	11:15:00 AM	1.041	0.542
	9/14/93	1:25:00 PM	0.462	0.904
SW093	4/5/93	NA	0.928	1.5
	5/17/93	NA	10.8	0.61
	5/28/94	1:24:00 PM	1.168	1.7
	5/31/94	7:13:00 PM	1.084	0.81
	6/21/94	6:41:00 PM	3.163	1.5
	6/22/94	6:04:00 PM	0.473	1.3
	8/10/94	9:43:00 PM	3.470	0.83
	10/17/94	7:03:00 AM	1.080	0.8
	4/26/95	12:55:00 PM	5.554	1.2
	5/16/95	9:13:00 PM	5.470	0.67
	5/26/95	10:27:00 PM	10.751	0.578
	6/28/95	3:52:00 PM	7.850	1.238

Table 3-8 Uranium-238 Data for North Walnut Creek

Site	Date	Sample Time	Average of Flow (CFS)	Average of U-238 (pCi/L)
GS13	4/30/91	3:21:00 PM	3.51	0.750
	5/15/91	2:58:00 PM	3.38	1.500

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Site	Date	Sample Time	Average of Flow (CFS)	Average of U-238 (pCi/L)
	5/16/91	7:57:00 PM	3.50	0.935
	5/22/91	9:28:00 PM	3.50	0.990
	7/3/91	1:53:00 AM	0.18	3.100
	7/11/91	9:11:00 AM	0.42	3.200
	8/6/91	5:23:00 PM	4.68	1.900
	8/9/91	5:45:00 PM	3.05	1.100
	6/1/92	3:09:00 PM	1.45	1.300
	10/26/92	2:15:00 PM	0.13	0.210
	4/5/93	NA	0.55	2.900
GS13	5/17/93	3:25:00 PM	1.54	0.442
	5/17/93	NA	4.42	1.100
	9/2/93	1:15:00 PM	0.44	1.458
	9/5/93	2:30:00 PM	0.07	3.691
	9/5/93	11:25:00 AM	0.31	1.099
	9/13/93	11:15:00 AM	1.04	0.858
	9/14/93	1:25:00 PM	0.46	1.602
SW093	4/5/93	NA	0.93	1.850
	5/17/93	NA	10.80	0.850
	5/28/94	1:24:00 PM	1.17	1.700
	5/31/94	7:13:00 PM	1.08	0.010
	6/21/94	6:41:00 PM	3.16	1.500
	6/22/94	6:04:00 PM	0.47	1.500
	8/10/94	9:43:00 PM	3.47	0.830
	10/17/94	7:03:00 AM	1.08	1.400
	4/26/95	12:55:00 PM	5.55	0.670
	5/16/95	9:13:00 PM	5.47	0.238
	5/26/95	10:27:00 PM	10.75	0.506
	6/28/95	3:52:00 PM	7.85	0.914

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3.3 TRITIUM DATA

Table 3-9 Tritium Sample Results from Sampling Location SW095 (ITS Central Sump)

SW095 Sample Number	Sample Date	Tritium (pCi/L)
SW70165JE	11/8/93	960
SW70173JE	2/15/94	1100
SW70196JE	5/9/94	1100
SW70221JE	5/16/94	1100
SW70285JE	11/7/94	930
SW70286JE	2/7/95	1000
Average		1032

Table 3-10 Tritium Sample Results from Pond A3 and Pond A-3 Effluent

A-3, A-3EFF Sample Number	Sample Date	Tritium (pCi/L)
NP56128WC	3/26/91	63.0
NP56144WC	3/27/91	5.0
NP56157WC	3/28/91	273.0
NP56649WC	5/15/91	18.0
NP56662WC	5/16/91	0.0
NP56683WC	5/17/91	16.0
NP56684WC	5/18/91	0.0
NP56692WC	5/19/91	0.0
NP56704WC	5/20/91	78.0
NP56721WC	5/21/91	96.0
NP56853WC	6/3/91	0.0
NP56868WC	6/4/91	142.0
NP56893WC	6/5/91	58.0
NP56903WC	6/6/91	103.0
NP56924WC	6/7/91	12.0
NP56946WC	6/8/91	66.0
NP56948WC	6/9/91	199.0
NP56963WC	6/10/91	62.0
NP56975WC	6/11/91	124.0

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A-3, A-3EFF Sample Number	Sample Date	Tritium (pCi/L)
NP57000WC	6/12/91	10.0
NP57013WC	6/13/91	123.0
NP57024WC	6/14/91	0.0
NP57036WC	6/15/91	21.0
NP57044WC	6/16/91	95.0
NP57430WC	7/25/91	3.0
NP57432WC	7/26/91	0.0
NP57433WC	7/27/91	0.0
NP57846WC	9/13/91	62.0
NP57947WC	9/23/91	2.0
NP57958WC	9/24/91	60.0
NP57965WC	9/25/91	224.0
NP57972WC	9/26/91	89.0
NP59594WC	2/22/92	64.0
NP59607WC	2/23/92	35.0
NP59619WC	2/24/92	0.0
NP59633WC	2/25/92	65.0
NP59646WC	2/26/92	103.0
NP59661WC	2/27/92	93.0
NP59905WC	3/15/92	246.4
NP59913WC	3/16/92	0.0
NP59929WC	3/17/92	0.0
NP59943WC	3/18/92	153.0
NP59954WC	3/19/92	30.6
NP59989WC	3/21/92	0.0
NP60003WC	3/22/92	0.0
NP60015WC	3/23/92	0.0
NP60031WC	3/24/92	0.0
NP60040WC	3/25/92	0.0
NP60057WC	3/26/92	83.3
NP60072WC	3/27/92	0.0

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A-3, A-3EFF Sample Number	Sample Date	Tritium (pCi/L)
NP60082WC	3/28/92	3.9
NP60098WC	3/29/92	86.6
NP60126WC	3/31/92	383.1
NP60182WC	4/3/92	0.0
NP60419WC	4/21/92	0.0
NP60524WC	4/29/92	24.9
NP60525WC	4/29/92	67.3
NP60526WC	4/29/92	106.4
NP60522WC	4/30/92	124.8
NP60531WC	5/1/92	129.7
NP60541WC	5/2/92	0.0
NP60549WC	5/3/92	0.0
NP60997WC	6/13/92	5.3
NP61031WC	6/16/92	48.2
NP61044WC	6/17/92	0.0
VW00192WC	8/1/92	28.4
VW00204WC	8/2/92	208.8
VW00213WC	8/3/92	0.0
VW00220WC	8/3/92	0.0
VW00227WC	8/4/92	31.8
VW00243WC	8/5/92	0.0
VW00802WC	9/22/92	0.0
VW00807WC	9/23/92	1029.2
VW00819WC	9/24/92	66.7
VW00853WC	9/26/92	72.1
VW00865WC	9/27/92	109.5
VW00875WC	9/28/92	58.3
VW02045WC	1/22/93	0.0
VW02463WC	3/5/93	0.0
VW00012JE	3/6/93	0.0
VW00015JE	3/7/93	0.0

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A-3, A-3EFF Sample Number	Sample Date	Tritium (pCi/L)
VW00024JE	3/8/93	359.6
VW00385JE	4/7/93	26.9
VW00391JE	4/8/93	0.0
VW00413JE	4/10/93	0.0
VW00427JE	4/11/93	0.0
VW00438JE	4/12/93	62.2
VW00448JE	4/13/93	59.7
VW00457JE	4/14/93	0.0
VW00487JE	4/15/93	0.0
VW00505JE	4/16/93	0.0
VW00513JE	4/17/93	16.0
VW00527JE	4/18/93	12.1
VW00536JE	4/19/93	0.0
VW00917JE	5/19/93	0.0
VW00922JE	5/20/93	0.0
VW00937JE	5/21/93	0.0
VW01317JE	6/24/93	196.1
VW01330JE	6/25/93	35.8
VW01338JE	6/26/93	62.4
VW01349JE	6/27/93	77.9
VW01358JE	6/28/93	15.5
VW01364JE	6/28/93	0.0
VW01366JE	6/28/93	155.0
VW01373JE	6/29/93	0.0
VW02931JE	12/14/93	135.8
VW02935JE	12/15/93	0.0
VW02942JE	12/15/93	147.1
VW02944JE	12/15/93	0.0
VW02947JE	12/16/93	71.0
VW02956JE	12/17/93	35.0
VW06890JE	2/14/94	141.9

A-3, A-3EFF Sample Number	Sample Date	Tritium (pCi/L)
VW06904JE	2/15/94	0.0
VW06915JE	2/16/94	76.5
VW06925JE	2/17/94	18.0
VW06931JE	2/17/94	3.9
VW06936JE	2/18/94	50.4
VW07555JE	4/13/94	139.5
VW07560JE	4/14/94	217.2
VW07567JE	4/14/94	38.6
VW07569JE	4/14/94	0.0
VW07600JE	4/17/94	176.9
VW07612JE	4/18/94	0.0
VW07622JE	4/19/94	96.6
VW07634JE	4/20/94	45.8
VW07647JE	4/21/94	36.7
VW07671JE	4/22/94	0.0
VW08038JE	5/23/94	146.4
VW08052JE	5/24/94	0.0
VW08066JE	5/25/94	0.0
VW08077JE	5/26/94	0.0
VW08088JE	5/27/94	0.0
VW08456JE	6/28/94	142.5
VW08457JE	6/28/94	4.8
VW08459JE	6/28/94	0.0
VW08464JE	6/29/94	23.7
VW08477JE	6/30/94	2.3
VW08487JE	7/1/94	36.6
VW08906JE	8/8/94	0.0
VW08922JE	8/9/94	11.0
VW08933JE	8/10/94	0.0
VW08943JE	8/10/94	131.4
VW09481JE	9/28/94	198.9

A-3, A-3EFF Sample Number	Sample Date	Tritium (pCi/L)
VW09494JE	9/29/94	71.9
VW09505JE	9/30/94	101.6
VW21082JE	4/24/95	0.0
VW21113JE	4/26/95	0.0
VW21107JE	4/27/95	46.1
VW21118JE	4/28/95	13.1
VW21128JE	4/29/95	77.9
VW21139JE	4/30/95	0.0
VW21145JE	4/30/95	168.0
VW21149JE	5/1/95	0.0
VW21162JE	5/2/95	0.0
VW21178JE	5/3/95	0.0
VW21193JE	5/4/95	28.5
VW21203JE	5/5/95	0.0
VW21335JE	5/17/95	58.1
VW21350JE	5/18/95	165.2
VW21360JE	5/18/95	404.9
VW21365JE	5/19/95	151.7
VW21399JE	5/21/95	9.7
VW21412JE	5/22/95	0.0
VW21424JE	5/23/95	0.0
VW21444JE	5/24/95	35.2
VW21458JE	5/25/95	0.0
VW21474JE	5/26/95	0.0
VW21487JE	5/27/95	218.7
VW21505JE	5/28/95	125.3
VW21520JE	5/29/95	4.1
VW21532JE	5/30/95	84.5
VW21553JE	5/31/95	74.5
VW21566JE	6/1/95	0.0
VW21581JE	6/2/95	0.0

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A-3, A-3EFF Sample Number	Sample Date	Tritium (pCi/L)
VW21594JE	6/3/95	0.0
VW21613JE	6/4/95	0.0
VW21628JE	6/5/95	0.0
VW21658JE	6/7/95	195.2
VW21674JE	6/8/95	0.0
VW21685JE	6/9/95	0.0
VW21698JE	6/10/95	0.0
VW21720JE	6/11/95	0.0
VW21740JE	6/12/95	0.0
VW21760JE	6/13/95	70.7
VW21776JE	6/14/95	0.0
VW21788JE	6/15/95	141.8
Average		**58.7**

Table 3-11 Tritium Sample Results from Pond B-5 and Pond B-5 Effluent

B-5, B-5EFF Sample Number	Sample Date	Tritium (pCi/L)
NP50283WC	1/14/91	124.5
NP55516WC	1/21/91	66.0
NP55581WC	1/28/91	14.0
NP55648WC	2/4/91	0.0
NP55718WC	2/11/91	0.0
NP55781WC	2/18/91	83.0
NP55851WC	2/25/91	232.0
NP50296WC	2/27/91	194.9
NP55916WC	3/4/91	118.0
NP50299WC	3/7/91	58.1
NP55982WC	3/11/91	0.0
NP50304WC	3/12/91	211.3
NP50307WC	3/18/91	175.6
NP56048WC	3/18/91	237.0
NP50310WC	3/25/91	76.3

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B-5, B-5EFF Sample Number	Sample Date	Tritium (pCi/L)
NP56116WC	3/25/91	100.0
NP50314WC	4/1/91	31.1
NP56193WC	4/1/91	0.0
NP50319WC	4/8/91	222.3
NP56259WC	4/8/91	154.0
NP50323WC	4/16/91	214.0
NP56395WC	4/22/91	0.0
NP50340WC	4/29/91	0.0
NP56469WC	4/29/91	99.0
NP50344WC	5/6/91	0.0
NP56549WC	5/6/91	263.0
NP50349WC	5/13/91	141.0
NP56709WC	5/20/91	156.0
NP50360WC	5/21/91	175.4
NP56782WC	5/27/91	65.0
NP50366WC	5/28/91	163.1
SW80129WC	5/28/91	137.2
NP50375WC	6/3/91	0.0
NP56851WC	6/3/91	45.0
NP56961WC	6/10/91	0.0
NP50385WC	6/13/91	109.9
NP50391WC	6/13/91	66.5
NP50392WC	6/13/91	232.4
NP50393WC	6/17/91	198.5
NP57064WC	6/17/91	132.0
NP50399WC	6/24/91	78.2
NP57136WC	6/24/91	11.0
NP50404WC	7/1/91	98.6
NP57212WC	7/1/91	39.0
NP57281WC	7/8/91	179.0
NP50403WC	7/10/91	54.1

B-5, B-5EFF Sample Number	Sample Date	Tritium (pCi/L)
NP57338WC	7/15/91	89.0
NP50420WC	7/16/91	0.0
NP50423WC	7/22/91	137.6
NP57388WC	7/22/91	0.0
NP57442WC	7/29/91	109.0
NP50426WC	7/30/91	80.9
NP50429WC	8/5/91	94.9
NP57492WC	8/5/91	32.0
NP57552WC	8/12/91	165.0
NP50435WC	8/13/91	188.3
NP57606WC	8/19/91	129.0
NP50443WC	8/20/91	12.0
NP50447WC	8/26/91	0.0
NP57660WC	8/26/91	0.0
NP57719WC	9/2/91	97.0
NP50451WC	9/3/91	0.0
NP50464WC	9/9/91	310.0
NP57793WC	9/9/91	12.0
NP50468WC	9/16/91	770.0
NP57868WC	9/16/91	0.0
NP57944WC	9/23/91	112.0
NP50471WC	9/24/91	1200.0
NP50474WC	9/30/91	110.0
NP58011WC	9/30/91	48.0
NP50485WC	10/7/91	210.0
NP58072WC	10/7/91	68.0
NP50491WC	10/14/91	370.0
NP58117WC	10/14/91	37.0
NP50495WC	10/21/91	16.0
NP58167WC	10/21/91	175.0
NP58229WC	10/28/91	0.0

B-5, B-5EFF Sample Number	Sample Date	Tritium (pCi/L)
NP50498WC	10/30/91	89.0
NP58299WC	11/4/91	78.0
NP58383WC	11/11/91	79.0
NP58388WCD	11/11/91	32.0
NP58468WC	11/18/91	0.0
NP50511WC	11/20/91	180.0
NP58541WC	11/25/91	0.0
NP58609WC	12/2/91	0.0
NP58699WC	12/9/91	46.0
NP58703WCD	12/9/91	234.0
NP58782WC	12/16/91	193.0
NP50534WC	12/18/91	84.5
NP58861WC	12/23/91	0.0
NP58954WC	12/30/91	11.0
NP59038WC	1/6/92	309.0
NP59207WC	1/20/92	0.0
NP59296WC	1/27/92	69.0
NP59366WC	2/3/92	0.0
NP59446WC	2/10/92	0.0
NP59523WC	2/17/92	0.0
NP59623WC	2/24/92	153.0
NP50558WC	3/10/92	0.0
NP50561WC	3/11/92	0.0
NP59815WC	3/12/92	0.0
NP59921WC	3/16/92	144.5
NP60019WC	3/23/92	0.0
NP60406WC	4/20/92	116.3
NP60482WC	4/27/92	0.0
NP60699WC	5/18/92	171.0
NP50604WC	5/27/92	160.0
NP60841WC	6/1/92	0.0

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B-5, B-5EFF Sample Number	Sample Date	Tritium (pCi/L)
NP50611WC	6/3/92	200.0
NP61314WC	7/13/92	61.2
VW00127WC	7/27/92	15.5
VW00214WC	8/3/92	203.6
VW00461WC	8/24/92	168.9
VW00466WC	8/24/92	180.0
VW00533WC	8/31/92	203.3
NP50685WC	9/8/92	98.0
VW00701WC	9/14/92	142.3
VW00782WC	9/21/92	289.4
VW00876WC	9/28/92	97.3
NP50725WC	11/15/92	160.0
SW50062JE	5/25/93	0.0
SW50063JE	5/25/93	26.4
SW50068JE	7/1/93	73.0
SW50069JE	7/1/93	109.7
VW02033JE	9/7/93	371.7
VW02993JE	12/20/93	160.0
VW06980JE	2/22/94	125.7
VW07303JE	3/23/94	72.5
VW07305JE	3/24/94	28.0
VW07354JE	3/25/94	4.9
VW07709JE	4/26/94	272.8
VW08916JE	8/8/94	7.8
VW10008JE	11/14/94	0.0
VW21111JE	4/26/95	0.0
VW21115JE	4/27/95	0.0
VW21120JE	4/28/95	58.1
VW21130JE	4/29/95	0.0
VW21141JE	4/30/95	0.0
VW21151JE	5/1/95	155.4

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B-5, B-5EFF Sample Number	Sample Date	Tritium (pCi/L)
VW21164JE	5/2/95	126.2
VW21181JE	5/3/95	0.0
VW21186JE	5/3/95	186.5
VW21188JE	5/3/95	57.3
VW21196JE	5/4/95	0.0
VW21205JE	5/5/95	24.2
VW21216JE	5/6/95	0.0
VW21233JE	5/7/95	0.0
VW21345JE	5/17/95	0.0
VW21353JE	5/18/95	299.1
VW21382JE	5/20/95	0.0
VW21401JE	5/21/95	159.6
VW21414JE	5/22/95	280.4
VW21426JE	5/23/95	0.0
VW21447JE	5/24/95	26.5
VW21461JE	5/25/95	0.0
VW21476JE	5/26/95	0.0
VW21544JE	5/27/95	224.0
VW21546JE	5/28/95	38.5
VW21547JE	5/29/95	0.0
VW21548JE	5/30/95	21.1
VW21556JE	5/31/95	0.0
VW21569JE	6/1/95	2.4
VW21583JE	6/2/95	0.0
VW21596JE	6/3/95	0.0
VW21615JE	6/4/95	0.0
VW21630JE	6/5/95	8.0
VW21661JE	6/7/95	146.1
VW21676JE	6/8/95	0.0
VW21687JE	6/9/95	139.0
VW21700JE	6/10/95	0.0

B-5, B-5EFF Sample Number	Sample Date	Tritium (pCi/L)
VW21722JE	6/11/95	85.4
Average		97.0

4.0 CONCLUSION

Based on an evaluation of water-quality and water-quantity parameters, the feasibility of an alternate plan for the management of ITS water is demonstrated. Under the terms of the draft RFCA, water quality must meet applicable standards at a point of compliance before the water is released from the Site. The management plan presented and supported here provides for the release of the ITS water under controlled conditions to meet the requirements of the draft RFCA and to avoid further costly treatment of the water.

5.0 REFERENCES

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